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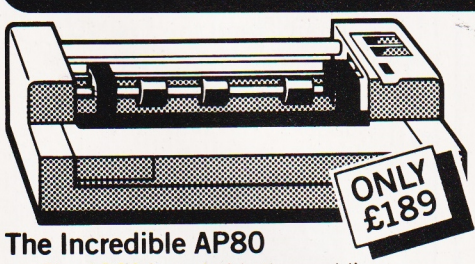

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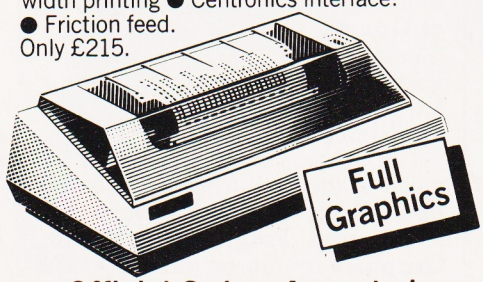

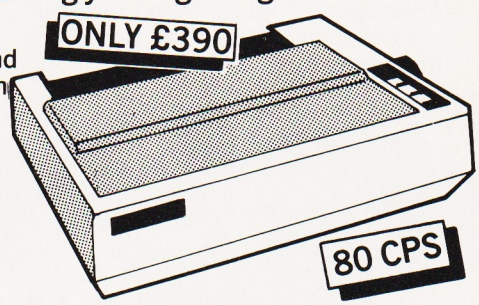

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CONSUMER NEWS

COMMODORE'S MICRO MEGASTAR

A swift million sales of the VIC-20 have boosted it into the top selling position, overtaking even Clive's ZX series on sales of a single machine. The current figures are based on 800,000 sales in the US plus 200,000 in Europe and Commodore have taken the opportunity to confirm that the VIC-20 will not be replaced by the forthcoming VIC-10 (Max) system or even the possible 16K version of the Commodore 64.

Not satisfied with announcing figures like these Commodore have also launched an add-on 40- or 80-column card. Developed by Stack Computer Services for Commodore the card is initially available only to members of VICSOFT, the VIC-20 owners club. Priced at £115 (inclusive of VAT) the card generates a second display which is used as an alternative to the 22 by 23 screen format produced by the VIC-20. All the normal VIC characters are available in upper and lower case and the screen editing system is also preserved. The screen is under software control with the various character options and formats under keyboard control. This means that it is possible to write a program using the new screen and yet present the display in normal VIC-20 format, a very useful feature for software developers and serious programmers who find the small screen makes program editing very tedious.

For more information on the new card and the VICSOFT organisation contact VICSOFT at 818 Leigh Road, Trading Estate, Slough, Berks SL1 4BD or ring Slough 73638.

A VESTED INTEREST?

Regular readers of *Computing Today* will know that we publish a monthly Book Review page but here are a few extra books that will probably not appear within those columns. Why, you ask, aren't they good enough? Certainly not, they are all excellent but there's just one problem. Virtually all the books in the new Hobbyist series from Granada have been written by regular contributors to *Computing Today* and several of them were put together under the guidance of the Editor of this magazine, see what we mean about a vested interest!

The titles from Granada that are already out include **The Spectrum Programmer** by S M Gee, **The ZX Spectrum** by Ian Sinclair and **The Spectrum Book of Games** by Mike James, S M Gee and Kay Ewbank. Priced at £5.95 each they should all be found at your local bookshop by Christmas at the latest.

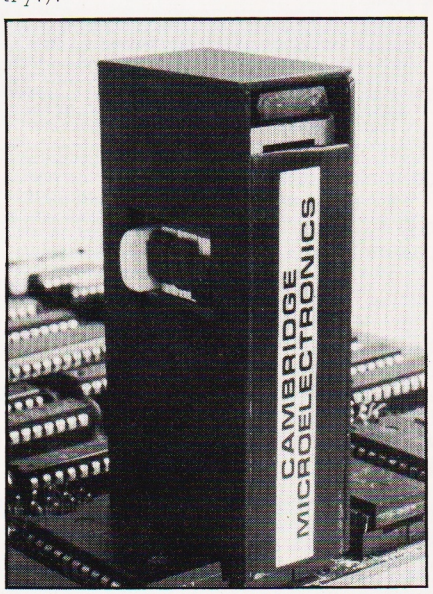
Following smartly on from these in the New Year will be; **The BBC Micro, an expert guide** by Mike James, **Programming With Graphics** by Garry Marshall, **The Complete Programmer** by Mike James, **Commodore 64 Computing** by Ian Sinclair, **The Dragon 32 Book of Games** by Mike James, S M Gee and Kay Ewbank, **Simple Interfacing Projects** by Owen Bishop, **Computer Languages and their uses** by Garry Marshall, **21 Games For The BBC Micro** by Mike James, S M Gee and Kay Ewbank and, finally, **Electronic Speech Synthesis; Techniques, Technology and Applications** edited by Geoff Bristow.

Publication of this massive attack on the computer book world will commence in January and carry on until June. For information on the publications contact Granada Publishing at PO Box 9, St Albans, Herts AL2 2NF.

TIE A KNOT IN IT

The electronic equivalent of the knotted handkerchief is rapidly becoming apparent. Not, as long expected, the bubble memory (puns about the bubble's bubble bursting will be ignored) but battery powered CMOS RAMs. Just announced from Cambridge Microelectronics is a 1K or 2K CMOS unit which can be plugged into the space normally occupied by a 24 pin ROM.

The unit costs £29.95 and a full technical data sheet on the product should be available from the company at One Milton Road, Cambridge CB4 1UY or try ringing them on 0223-214814. As an absolute flyer I'm going to offer a totally free copy of our special publication, *Micro Choice*, to the first ten people to tell me just what computer the unit is plugged into on the photograph. Send your answer, on a postcard or the back of an empty, sealed envelope, to me by the end of December and I'll personally send the first 10 a copy, still warm from the presses (well, they'll be cold by the time they reach you but at least we try!).



BITS AND BOBS ▸ FROM BIB

Already well known for their range of audio aids, Bib have entered the micro accessory market with a range of cleaning products under the name Computa-Care. The initial launch consists of six products from VDU anti-static spray to cleaning discs. Prices of the items are £3.98 for the cassette head cleaner, £2.99 for the anti static VDU treatment, £8.74 for the tape transport maintenance kit, £8.74 for the terminal maintenance kit and £20.70 for the 5¼" and 8" disc cleaners.

Product information can be obtained from your local stockist or direct from Bib Computer Care Division, Kelsey House, Wood Lane End, Hemel Hempstead, Herts HP2 4RQ. Telephone enquiries should be directed to 0442-61291.

DRAGON BREATHES LIFE INTO METTOY

Owing to financial pressures Mettoy, the toy makers who set up Dragon Data, have been forced to sell off part of the burgeoning computer company to a consortium headed by the Pru's High Technology investment group. Prutec have headed up a six partner consortium in investing some £2.4 million in Dragon Data, they now hold the lion's share of the company, some 40%. Other partners include the Welsh Development Agency, Mettoy themselves and the National Water Council.

Tony Clarke, the Mettoy man-in-charge, is moving across to run the company and the investment will enable them to move into new premises in Swansea. Hopefully this will enable them to achieve their aim of capturing some 5% of the UK computer market by the end of 1983.

Rumours of short supply of the Dragon 32 were not confirmed when I spoke to the company recently but, with the Christmas market reaching its peak around the time this magazine hits the streets, it would be a shame if shortage of stocks affected the system's success.

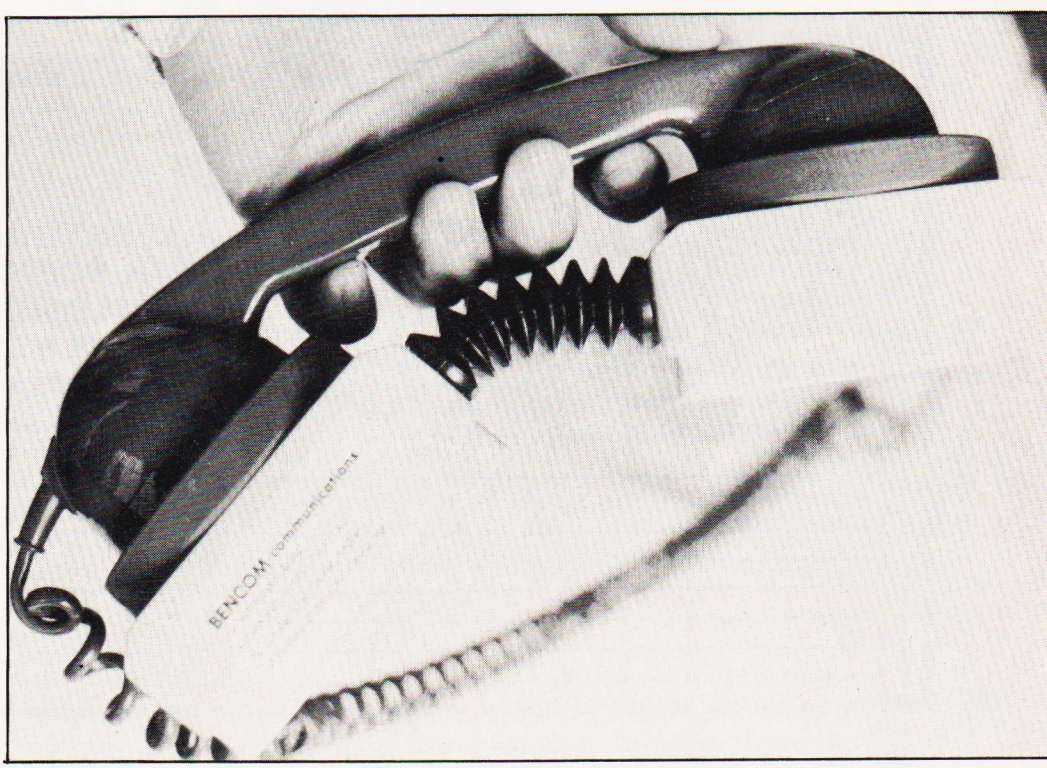
Information on the Dragon 32 home computer can be obtained from Dragon Data, Queensway, Swansea Industrial Estate, Swansea, Glamorgan SA5 4EH.

ROARING DOWN THE LINE ▾

No, we're not talking about the Inter City 125 but a new range of acoustic couplers being marketed by Lion House. Manufactured in Australia they will be sold through Lion Micro Computers for £269 plus VAT, bulk discounts are available.

The units will operate in both originate and answer mode which means that you can use them for remote operations and they cater for both 300 and 1200 baud rates. Interestingly, they are also capable of operating at the split rate of 1200/75 which means that you can access Prestel with them. Lion have prepared a special version for use with the Osborne 1 system which is fully compatible with their COMMs software package for electronic mail applications.

For more detailed information contact Lion Micro Computers at Lion House, 227 Tottenham Court Road, London W1P 0HX or give them a ring on 01-580 7383. One thing we can promise you — it's unlikely that you'll get to talk to Roy Kinnear!



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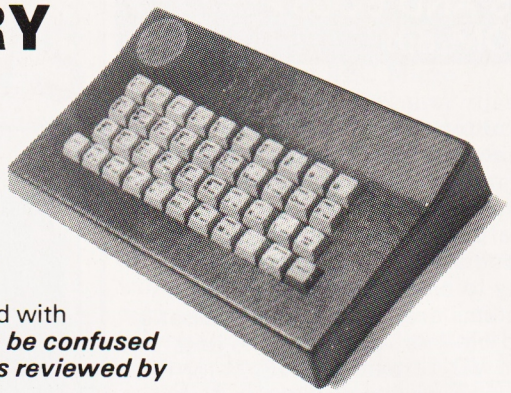

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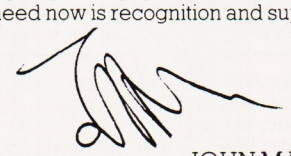
It is not easy to analyse the reasons for this situation arising. Obviously, the fact that we are an English-speaking country has had significant influence since the industry has been led from its early days by the Americans. Next, we do appear a naturally ingenious people. The number of inventions generated from within these islands is out of proportion to the population when compared to some of our other trading partners. Regrettably however, these opportunities slipped through our hands and were developed elsewhere. Finally, there has been a very strong hobby electronics market and this has possibly been the most important single influence since so many microcomputer companies owe their origins to the dedicated enthusiast.

There are a wide range of machines available from British manufacturers. In most cases, the products are very competitive and, for this reason, it should not be difficult for the potential customer to find a British-made solution for his particular requirement. However, I believe that this attitude should be extended and that the Government, local authorities and other bodies should do their utmost to ensure that they buy British and they should try to influence other people to buy British. For instance, there seems little benefit to anyone if a Government body actively or passively promotes overseas' manufactured equipment. Unfortunately, this is the case. What everybody should remember is that buying British means generating jobs here.

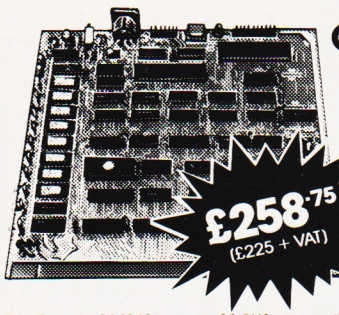
Few people realise that for some strange reason, the Government of this country and its EEC partners, have rigged import duties to the disadvantage of the UK manufacturer. Manufactured computer systems attract duty of between 6-7%. Many of the components needed to build computer systems are only manufactured overseas and in particular, the 17% duty on semi-conductors gives the importers virtually a 10% edge on their domestic rivals. Whilst I acknowledge the fact that it would be difficult to force through changes rapidly, there must be a way of giving temporary relief to our industry. The Government have the authority to waive duty in certain instances on an ad hoc basis and this could be considered. It really makes no sense for the tax payer's money to be spent on foreign products or the import duty paid by manufacturers on their component supplies.

If all prospective microcomputer customers gave very careful consideration to the UK manufacturers' machines instead of imported ones, the sheer volume of business available would provide the profits that are needed to pay for the large R&D programmes we all have to sustain. Successful development mean lower prices and even more competition for our foreign counterparts. I believe that the manufacturers in this country have proven that they have the capability of manufacturing and designing the equipment which the market place wants. What we need now is recognition and support.



JOHN MARSHALL
MicroValue Group/Gemini Microcomputers Ltd.

MULTIBOARD



GM813 — CPU/64K RAM Board

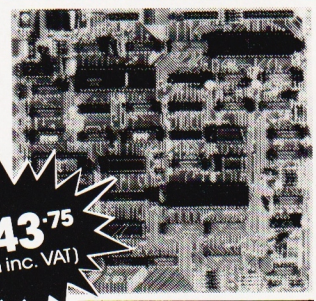
- ★ 4 MHz Z80A CPU
- ★ 64K Dynamic RAM
- ★ RS232 Serial Interface
- ★ Two 8-Bit I/O Ports
- ★ 1200 Baud Cassette Interface
- ★ Extended and Page Addressing Modes

£258.75 (£225 + VAT)

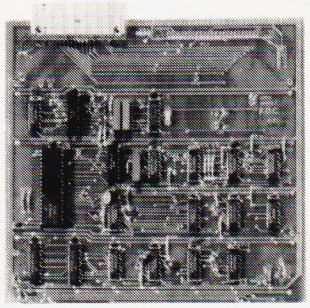
The Gemini GM813 is a new 80-BUS compatible CPU card incorporating 64K dynamic RAM and utilising the powerful Z80A microprocessor running at 4MHz. Extended addressing and page mode facilities allow for future memory expansion up to 2 megabytes. Input and output capabilities include both programmable serial and parallel interfaces — RS232, 1200 baud CUTS cassette interface and the Z80A PIO. When used with the GM812 video card, the GM813's unique RP/M monitor allows the creation of cassette or EPROM based programs or files which are upwards compatible with a disk based CP/M system.

GM811 — CPU Board

- ★ 4MHz Z80A CPU
- ★ Four 'Bytewide' Memory Sockets
- ★ Two 8-Bit Input/Output Ports
- ★ 8 Bit Input Port
- ★ RS232 Serial Interface
- ★ 1200 Baud CUTS Cassette Interface

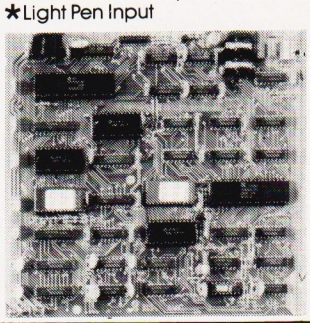


£143.75 (each inc. VAT)



GM812 — IVC Board

- ★ 80x25 Display Format
- ★ On-board Z80A Microprocessor
- ★ Buffered Keyboard Input
- ★ Programmable Character Generator
- ★ 160x75 Pixel Graphics
- ★ Light Pen Input



GM809 — FDC Board

- ★ Disk Controller Board
- ★ Single/double density
- ★ Single/double sided
- ★ 8" or 5.25" Drives

Other boards available in the Multiboard range include:

GM802	64K Dynamic RAM Board	**£143.75 inc. VAT**
GM803	EPROM/ROM Board	**£ 74.75 inc. VAT**
GM816	MULTI-I/O Board	**£143.75 inc. VAT**
MP826	32K Static RAM Board	**£212.75 inc. VAT**
PLUTO	Colour Graphics Board	**£458.85 inc. VAT**

Send for latest catalogue for full details.

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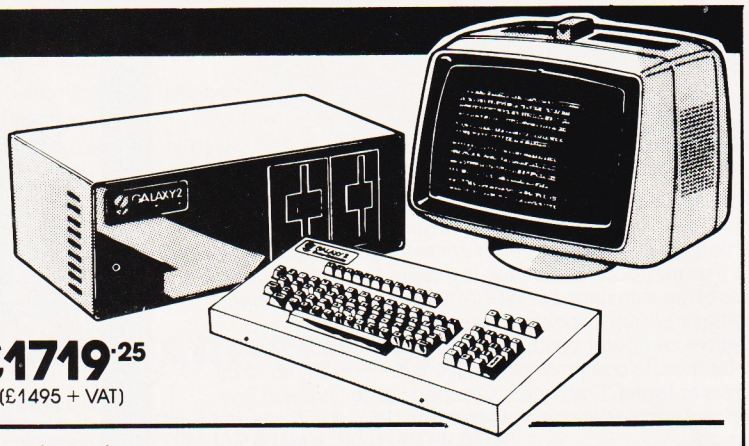
COMPUTERS

New from Gemini

Gemini Galaxy 2

- ★Twin Z80A Processors
- ★CP/M 2.2 Operating System
- ★64K Dynamic RAM
- ★800K Disk Capacity
- ★80x25 Video Display
- ★Serial and parallel printer interfaces
- ★Cassette and light pen interfaces
- ★User definable function keys
- ★Numerical key pad
- ★12" Monitor included

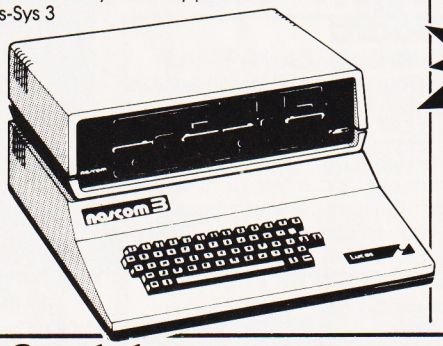


£1719.25
(£1495 + VAT)

Total support for Gemini & nascom Products

nascom 3 available from MicroValue

Based around the successful Nascom 2 computer, this new system can be built up into a complete disk based system. Supplied built and tested complete with PSU, Nas-Sys 3 and Nas-Gra.



48K System
£631.35 (£549 + VAT)

CP/M 2.2
£115 (£100 + VAT)

NASCOM 2 KIT
£258.75 (£225 + VAT)

Built & Tested
£327.75 (£285 + VAT)

80x25 Video for nascom

NEW LOW PRICE

Nascom owners can now have a professional 80x25 Video display by using the Gemini G812 Intelligent Video Card with on-board Z80A. This card does not occupy system memory space and provides over 50 user controllable functions including prog character set, fully compatible with Gemini G805 and G815/809 Disk Systems. Software supplied on Gemini system disks. Built and tested.

£143.75 (£125 + VAT)

Nascom 1 Printed Circuit
(inc. parts list)
£28.75 (£25 + VAT)

GM802 64K RAM Card **£143.75** (£125 + VAT)

GM802K 16K RAM Kit **£92** (£80 + VAT)

Disk System for Gemini & nascom

GM825 Disk Drive Unit – The GM825 floppy disk housing is supplied with either one or two 5.25" single sided, double density, 96TPI high capacity Micropolis 1015F5 disk drives. These provide 400K bytes of formatted storage per drive. (Gemini QDSS format). The CP/M2.2 package available supports on-screen editing with either the normal Nascom or Gemini IVC screens, parallel or serial printers and auto single-double density selection. An optional alternative to CP/M is available for Nascom owners wishing to support existing software. Called POLYDOS 4, it includes an editor and assembler and extends the Nascom BASIC to include disk commands.

Single Drive System
GM825-1S
£402.50 (£350 + VAT)

Dual Drive System
GM825-2S
£661.25 (£575 + VAT)

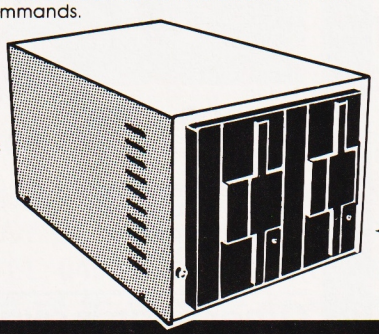
CP/M2.2 Package
(G513) for Gemini
£103.50 (Inc. VAT)

CP/M2.2 Package
(G513) for Nascom
£115.00 (Inc. VAT)

POLYDOS 4
for Nascom
£103.50 (£90 + VAT)

GM809 Disk Controller Card
for 8" and 5.25" drives
£143.75 (£125 + VAT)

GM829
for 8", 5.25" and Winchester Drives
£166.75 (£145 + VAT)

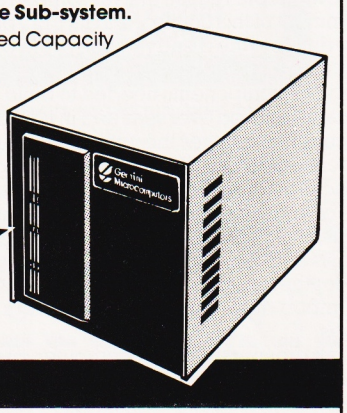


At last – a Winchester Drive for your Gemini / nascom System!

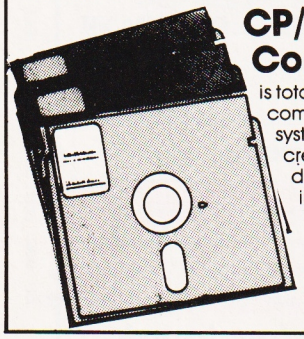
GM835 Winchester Drive Sub-system.

- ★5.4 Megabyte Formatted Capacity
- ★Rodime Drive
- ★Industry Standard SASI interface
- ★Integral Controller and power supply

£1450 + VAT



SOFTWARE



CP/M Software Compas

is totally different from other compiler based Pascal systems, as it allows you to create, edit, run, and debug Pascal programs in a highly interactive manner.

£138.00 (inc. VAT)

'The Last One' is used in conjunction with Microsoft's MBASIC*. No knowledge of BASIC programming is required since all input is performed using question and answer routines written in plain English.

£379.50 (inc. VAT)

***MBASIC**—MicroValue Price if purchased with 'The Last One' **—£178.95 inc.VAT**

VIZ:APL is a high level language system. It can be used to develop small programs faster and large programs in limited memory. The language can be enhanced almost indefinitely and the user's own operators and functions can be built up.

£293.25 (inc. VAT)

Gemini Software:

GEM PEN Text Editor	**£51.75 inc. VAT**
GEM ZAP Assembler	**£51.75 inc. VAT**
GEM DEBUG Debugging Utility	**£34.50 inc. VAT**
WORDSTAR Word Processor	**£247.25 inc. VAT**
GEM GRAPHIC Links with MBASIC	**£40.25 inc. VAT**

A wide range of software for Nascom also available.

When ordering disks, please specify format.

Value - MicroValue - Micro

LOW COST SYSTEMS

Dragon 32

A powerful colour computer for under £200.
★32K RAM
★6809E Microprocessor
★Extended Microsoft Colour BASIC
★9 Colour, 5 Resolution Display
★Sound through TV 5 octaves, 255 tones
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FREE cassette with every Dragon purchased.

£199.50 (£173.47 + VAT)

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Now available through MicroValue — a real computer for less than £50!

★Sinclair ZX81 Computer	**£49.95** (£43.43 + VAT)
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★16K ZX RAM PACK	**£29.95** (£26.04 + VAT)
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★Software for Sinclair	**from £3.95 inc VAT**

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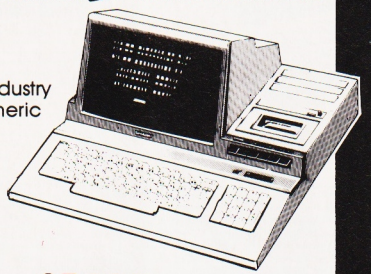
Z80A C.P.U. · 48K RAM · 4K ROM · Industry standard Qwerty keyboard with numeric pad · 9" GREEN C.R.T. · 1200 baud cassette · Music and sound · Real time clock · Enhanced BASIC · Full editing facilities · Internal expansion.

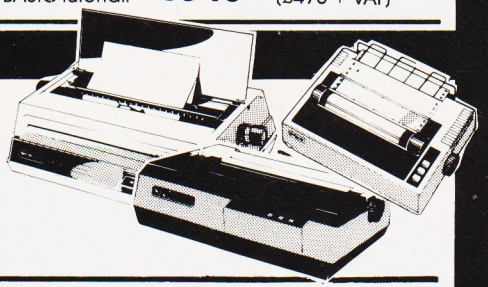


FREE SOFTWARE!

Home budget, bank reconciliation, SPACE INVADERS, STAR TREK, SCRAMBLE, bank loan calculator, mortgage calculator + 7 other games.
Educational — Geography, Maths., Spelling + 4 part BASIC tutorial.

£546.25 (£475 + VAT)

PRINTERS



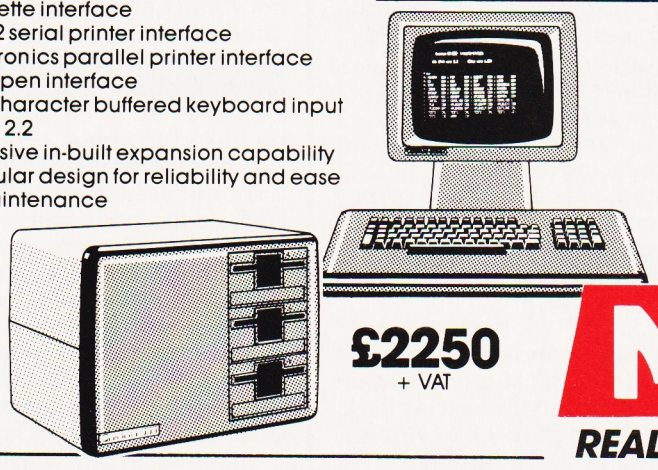
Epson MX80 Type III	**£399.95 inc. VAT**
Epson MX80 FT Type III	**£445.95 inc. VAT**
Epson MX100 Type III	**£569.95 inc. VAT**
NEC 8023A	**£389.95 inc. VAT**
SEIKOSHA GP100A	**£246.95 inc. VAT**

Daisy Wheel Printer:

Smith-Corona TP-1	**£557.75 inc. VAT**

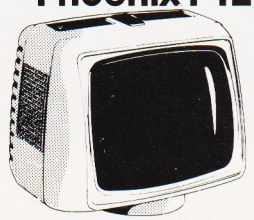
Quantum QM 2000 COMPUTER SYSTEM

* Twin Z80A Microprocessors
* 64K Dynamic RAM
* 2.4 megabytes of formatted disk storage capacity
* 80 × 25 screen format
* 160 × 75 pixel graphics
* Programmable character generator
* Cassette interface
* RS232 serial printer interface
* Centronics parallel printer interface
* Light pen interface
* 128 Character buffered keyboard input
* CP/M 2.2
* Extensive in-built expansion capability
* Modular design for reliability and ease of maintenance



£2250 + VAT

Phoenix P12 Monitor



A high quality data display monitor, ideal for all Nascom and Gemini systems. 20MHz resolution. Available in amber or green phosphor.

£126.50 (£110 + VAT)

MICROVALUE DEALERS:

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Amersham Computer Centre, Oakfield Corner, Sycamore Road.
Tel: (02403) 22307

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Skytronics MBM, 80 Bristol Street,
Tel: 021-622 6436

BRISTOL
Target Electronics Ltd., 16 Cherry Lane.
Tel: (0272) 421196

COLCHESTER
Emprise Electronics Ltd., 58 East Street.
Tel: (0206) 865926

EGHAM, SURREY
Electrovalue Ltd., 28 St. Judes Road, Englefield Green.
Tel: (07843) 3603

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MDW (Electronics), 47/49 Woodbridge Road East.
Tel: (0473) 78295

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Bits and P.C.'s Computer Products Ltd., Leeds Computer Centre, 60/62 Merrion Centre.
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Henry's Radio, 404 Edgware Road.
Tel: 01-402 6822

LONDON SW11
OFF Records, Computer House, 58 Battersea Rise, Clapham Junction.
Tel: 01-223 7730

MANCHESTER M19
EV Computing, 700 Burnage Lane.
Tel: 061-431 4866

NOTTINGHAM
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BUSINESS NEWS

BIT OF GOOD ▲ FORTUNE

While the debates still rage as to whether eight- or 16-bit systems are better/faster one company has cocked a snook at the rest of the industry. IBR Microcomputers have taken a UK distributorship for the Fortune 32:16 system which uses a 32/16 bit processor, the Motorola 68000. Unlike, say, the Intel 8086 which is a 16-bit micro inside but looks like an eight-bit machine to the outside world the 68000 has 32-bit internal architecture with 16-bit external data handling.

The operating system offered is UNIX with the option of CP/M and a wide range of software is available; languages, wordprocessing, database and financial packages etc. The basic system comes with 256K of RAM which is expandable to 1M, integral discs to the format you require, floppies or Winchester, plus the option of multi-user expansion using Ethernet.

Adding a second 68000 gives you the option to run colour graphics to the staggering resolution of 1024 by 1024 — that's nearly as good as a 625 line TV picture.

Information and prices can be obtained from IBR Microcomputers at Unit 57, Suttons Industrial Park, Reading, Berks RG6 1AZ or give them a ring on 0734-664111.

GET SOME ACTION

Run out of discs or perhaps your paper stocks are getting low again? Well, if they are, or if you're running out of any of those other vital supplies that keep your system, no matter how big or small, running then the new catalogues from Inmac and Action Computer Supplies should help solve the problem.

Reflecting two different approaches to the media supply market the companies both offer a selection of the basic necessities; floppy discs, printer ribbons and listing paper. However, while Action Computer Supplies offer a small range on a very fast turn round time, if you order by 5pm they'll post it by 6pm, Inmac offer a vast range of extras including computer room furniture, cables and a much wider range of the basic items. Inmac reckon that most orders will arrive on your desk one working day after the order is placed and also offer a 30-day trial period. One vital facility offered by both companies, especially for the smaller user is that you can pay with your credit card and there is no minimum order amount although small orders must be pre-paid.

If you would like your copy of these catalogues write to Action Computer Supplies, 6 Abercorn Trading Estate, Manor Farm Road, Alperton, Wembley, Middlesex HA0 1WL or Inmac, 18 Goddard Road, Astmoor Industrial Estate, Runcorn, Cheshire WA7 1QF.

LET OSBORNE TALK UNTO OSBORNE

Ok, so you can carry your computer around with you — at least if it's an Osborne you can. But, when you get to where you're going you might want more facilities than it can offer. No problem, just plug it into the network. Keen Computers have interfaced the Osborne to their Corvus hard discs for mass storage and to their Constellation network system so up to 64 Osbornes can be linked together.

This facility enables the roving Osborne user to share facilities such as the previously mentioned hard discs, printers and, of course, software and filed information. Keen have already provided these facilities for such other well known names as Apple, Commodore, IBM, Sirius, Tandy and Rank Xerox.

More information can be obtained from Keen Computers at 5 Giltspur Street, London EC1A

THE KEY TO WORDS▲

Ever used Wordstar? Chances are that you have, certainly if your system runs CP/M. Now, some like it and others hate it but almost everyone agrees that using it is certainly not made any easier by having all those awkward key combinations to press in order to summon up the various functions. In order to alleviate this problem the Wolfson Microelectronics Institute has introduced a separate keyboard unit that allows each Wordstar function to be selected by a single key depression.

Each of the 56 keys is legended and colour coded to make for easy identification. In order to speed up entry of the functions they have also grouped like functions together. The unit connects to the terminal of micro via an RS232 interface which supports baud rates between 300 and 38,400 so it should be a simple addition to most of the common desktop systems like the SuperBrain and the Advantage.

Priced at under £200 you should be able to obtain the unit through a local dealer or if you're after more details write to the Wolfson Microelectronics Institute, The King's Buildings, Mayfield Road, Edinburgh EH9 3JL.

CP/M GETS LISTED

Now in its third year of publication, the **CP/M Software Index** has just been released. Containing entries on some 1,688 professionally supported programs and packages supplied by 507 sources it must rate as the most authorative listing of its kind.

All the programs and packages are supported under CP/M-80 and many will also run under the newer versions such as CP/M-86 etc. The Index is broken down into five major sections; Systems Programs, General Applications, Accounting Applications, Utility Applications and Industry Specific. Each of these sections is further broken down into 89 categories ranging from High Level Languages to Dairy and Cattle Programs.

The growth in the software market is highlighted by the growth in the size of the Index, last year it only contained 740 programs from 248 sources. You can get your copy from Small Systems Group, Box 5429, Santa Monica, CA 90405 for just $14.

DO IT DOWN UNDER

Do you know the third biggest market for microcomputers in the World? No! Well, it's the land that brought you copious draughts of Paul Hogan and the Stylophone — Australia. And, from the 12th to 15th September next year they are holding the 10th Australian Computer Conference in Melbourne. Why are we telling you this now? Well, because they are asking for learned papers for the conference and, as it's IT year, the British Overseas Trade Board will also be subsidising a group of some 20 exhibitors from the UK.

If you are seriously interested in the Australian market and would like to register your business for consideration contact Alan Morrison or Carole Costello at Export IT, Queens Building, 10-11 Bishops Court, Old Bailey, London EC4M 7EL or ring them on 01-236 2741.

SERIOUS TALKING

Sirius Technology, the company that Chuck Peddle founded to make the Sirius 1, looks likely to be involved in a merger with the Kidde Corporation who also market the machine under the Victor 9000 label. Until recently the system was only available in the UK through ACT but in the Autumn the Victor 9000 was brought in by DRG Business Machines.

Details are currently confused as to who will be selling what when the talks reach their conclusion but the indications are that the system will continue to be known as the Sirius, at least for the European market. Whatever happens to the system's name no-one can take away the success that it has achieved over the last nine months or so, success due mainly to the active promotion of the product by ACT.

MOD PROOF MICRO▼

No, that's not the sort of Mod who listens to the Who's Greatest Hits and keeps the Italian scooter industry going but the Ministry of Defence. For a system to be accepted as capable of withstanding the effects of a quick 'yomp' it certainly has to be tough and the Husky system from DVW Microelectronics is nothing if not tough. So far in its short life the Wessex Water Authority have tried to drown it, they failed, the MOD have evaluated it and reckon that it will stand up to the sort of bashing they're likely to give it and BOC's vehicle fleet have tried to drive all over it without much success!

To further equip the robust little brute for its wild and exciting life in the field it has now been fitted with a 144K version of BASIC and this, together with its non-volatile memory and the ability to act as a roving terminal seem to have made it a roaring success. Prices start at around £1,300 and increase to £3,423 for the basic system with varying amounts of memory. More information can be obtained from the company at PO Box 135, 345 Foleshill Road, Coventry CV6 5RW.

Micromail

Mail Order Items	Net	Inc VAT and carriage
Apple Ii 48K	525.00	610.00
Apple Disk + Controller	275.00	320.00
Apple Disk without Controller	210.00	245.00
Micro-Sci Disk A40 + Controller	275.00	320.00
Micro-Sci Disk A40 without Controller	210.00	245.00
Zenith 12" Monitor	78.00	95.00
Bit 3 Full View 80 Column Card	175.00	205.00
Business Graphics	85.00	100.00
Language Card	75.00	90.00
Applewriter Ii	65.00	75.00
CCS Synchronous Serial Interface	75.00	87.00
CCS Parallel Interface	75.00	87.00
Dos 3.3 Toolkit	35.00	42.00
Mountain Hardware Romplus Card	85.00	100.00
Epson MX80FT/III Printer	345.00	400.00
Apple Interface for Epson	75.00	86.00
S100 CCS 16K Static Ram	120.00	140.00
S100 CCS 64K Dynamic Ram	200.00	235.00
S100 CCS 2 Parallel 2 Serial	125.00	145.00
S100 CCS Motherboard + Case + Power Supply	180.00	215.00
40 Track DD Verbatim Disks	17.00	21.00
77 Track DD Verbatim Disks	30.00	36.00
Your First Computer — Zaks	6.00	6.00
6502 Games — Zaks	9.00	9.00
Intro to Micros Vol. 0 — Osborne	6.00	6.00
Intro to Micros Vol. 1 — Osborne	8.00	8.00
Some Common Basic Programs — Poole	8.00	8.00
The Pet Revealed — Hampshire	9.00	9.00
Pet and the IEEE Bus — Fisher	9.00	9.00
6502 Applications — Zaks	9.00	9.00
Z80 Assembly Language Prog. — Leventhal	8.00	8.00
6800 Assembly Language Prog. — Leventhal	8.00	8.00
NEW SOFTWARE (ON CASSETTE)		
DRAGON		
Dragon Wordprocessor	10.87	12.50
Dragon Magic No. 1 (12 Programs)	4.78	5.50
BBC MICRO (MODEL B)		
Vogon Attack (with super graphics) + 4 other basic games	5.50	6.33
7 Educational games for 6-10 yr. olds	5.00	5.75
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9 Educational Programs for 4-7 yr. olds	5.00	5.75

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XTAL BASIC 3

A Z80 based Interpreter. Disc and Cassette versions including CP/M are available now or in the near future.

FEATURES

1. Has over **110** Commands and Functions and is user extendable.
2. **Xtal BASIC 3** incorporates its own editor that is independent of VDU or terminal being used but appears to have the facilities of the most sophisticated direct screen editing, in brief the editor contains the following:
   Lines of 127 characters (can be extended up to 254)
   Full on screen editing, up, down, left, right.
   Auto insertion of lines.
   HOME CURSOR, CLEAR SCREEN, DELETE LEFT, DELETE RIGHT, INSERT CHARACTER, ERASE WHOLE LINE, ERASE TO END OF SCREEN, PRINT SCREEN CONTENTS TO PRINTER, and ABANDON LINE. A LINE EDIT MODE IS INCLUDED AS STANDARD.
3. Variables can be of any length. First five characters used to distinguish one variable from another. Multi-dim arrays, string arrays and integer arrays.
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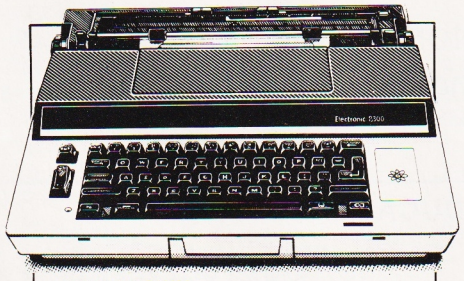

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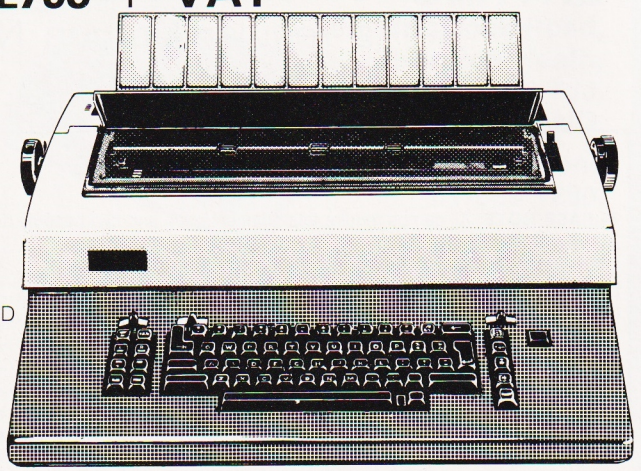

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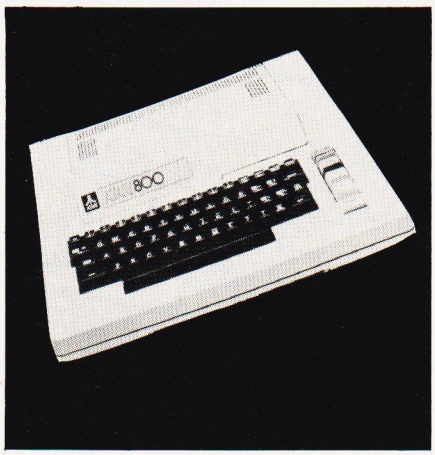


ATARI BUSINESS▲

Owners of the Atari 800 system who are wondering whether they will ever get any serious software to run on the machine can now all breathe a sight of relief. Just announced by Silicon Chip, the Slough based business computer specialists, is a range of packages under the name of Chipsoft which have been specially produced for the first time business user.

Currently there are five packages available; Stock Control, Sales Ledger, Purchase Ledger, Mail Shot and PAYE which are all written in the normal Microsoft BASIC. Each package costs £149.85 and is accompanied by documentation that is part of the software, the idea being that this makes it easier for the user. A training video is also avaiulable for rent if you should require this facility.

Silicon Chip estimate that a complete system for the small businessman would cost around £2000. For more information contact the company at 302 High Street, Slough, Bucks.

NASCOM GETS XTAL

What's that, you say, I always thought that the NASCOM had a crystal. Not this kind, it didn't. The sort of Xtal we're talking about is Crystal BASIC 3 or, to use Nascom's name, Enhanced BASIC. Selling for £40 plus VAT it requires a minimum configuration of 16K RAM plus NAS-SYS 3 and will run with any of the NASCOM range.

The original BASIC supplied with the NASCOM has become a little long in the tooth and the problems with its strings make this a very attractive alternative indeed. Even more attractive when you consider that you can add onto Xtal BASIC, as we've demonstrated in the past, to make your BASIC even more powerful.

More details of the language can be obtained from Nascom Microcomputer Division, 3 Warwick House, Station Road, Kenilworth, CV8 1JF. Alternatively, write to Crystal Research Ltd at 40 Magdalene Road, Torquay, Devon.

CAXTON GO ONE

After only a single year in business Britain's first specialist software publishers have clinched a deal with the Osborne Computer Corporation which will virtually guarantee some 10,000 plus sales per year of their Cardbox package.

Normally selling at £155 the product has taken off in a very big way, both in the US and on the home market with some dealers reporting a sale with every other machine that leaves the shop. With a big new launch due at the Software Expo in mid-November and the promise that Cardbox will be available on other systems shortly, the Sirius has been named as one, it looks as though Caxton could well get to celebrate their second birthday in real style!

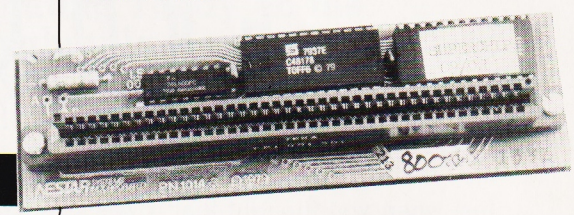
For information on Cardbox and Optimiser, the two current products, contact Caxton at 10-14 Bedford Street, Covent Garden, London WC2E 9HE.

THE BEAR BITES BACK

Tim Moore, affectionately known in the trade as The Bear, together with Jon Day seem to have made a considerable success of their departure last year from the NewBear store. The company they founded to carry on the work of supplying well written British software to the world in general, Kuma Computers, has added yet more material to its range.

The system that they will be using as their flagship is the Sirius (or will it be the Victor?) and following their recent introduction of FORTH for the machine they have just added a character set editing utility called CHEDIT. The program will run under either CP/M-86 or MS-DOS and allows the user to re-configure the character sets to suit special requirements or even add foreign alphabets that don't come as standard.

Kuma are also actively seeking software writers for the following systems; Sirius, Osborne, NewBrain, Dragon and the whole Sharp range. For product information or details about writing software for the company contact Tim Moore or Jon Day at 11 York Road, Maidenhead, Berks SL6 1AQ or give them a ring on 0628-71778.



THE TOOLKIT CARRIES▲ ON

If you've got one of the Commodore range of systems and you haven't got a BASIC Programmer's Toolkit, the great grand-daddy of all toolkits, then you must surely be in a minority. Until recently distributed by Zynar, part of the Rank Group, the product is now being handled by the company that brought you such delights as the Hitch Hikers Guide to the Galaxy adventure and the Superchip. Yes, Supersoft have now taken on the product but it might cause an unexpected problem. You see, Supersoft themselves have produced a range of utility chips that can be plugged into the Commodore range and many of you will now be rather short of sockets! Still, they reckon that with the addition of their 16 socket Super Pager board no-one will have any problems in adding the Toolkit to their already crammed machine. Over 10,000 Commodores in the UK are already believed to be fitted with the chip which must say something about its popularity.

Priced at £29 plus VAT the Toolkit can be obtained from your local Commodore dealer or direct from Supersoft at Winchester House, Canning Road, Harrow, Middlesex HA3 7SJ.

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THEY'RE AT IT AGAIN

Just when you thought that it was safe to go back to watching television without getting buried under hours of programmes about computers and suchlike technological objects you find that the BBC have let the owl out again.

Yes, on January 9th the BBC embark on a second series of the Computer Programme intended to bring all you micro owners a little light in the darkness. This series, subtitled Making the Most of Your Micro, is intended to look more closely at the ways in which micros are being used by their owners and the sort of problems that arise in programming them for these tasks.

Once again our ever faithful mole has been worming its way around the deeper recesses of Television Centre and will be bringing you the complete breakdown and scheduling of the new series together with all sorts of little snippets gathered during the making of the programmes.

So, before you turn on and tune in dash round to your local stockist of Computing Today and reserve your copy of the February issue — you won't find this information anywhere else!

FIND IT ON A NASCOM

Find what, you may well be asking. Anything (almost) comes the instant reply. Well certainly if it is something you've buried in a program and can't remember where that is.

In the first of a series of features showing how to add utility programs to your computer we investigate how you would go about adding a FIND command to your NASCOM. As serious programmers will know this function is worth its weight in Hex code as it will allow you to track down all those elusive BASIC keywords, subroutine jumps or even bits of text that you can never seem to fit onto the screen at the same time.

If you have ever lost a GOSUB or mislaid a POKE you'll certainly value the next issue of the computing person's guide to utility programming!

BITS OF BEEB

The trouble with that BBC Micro is that the darn thing is almost too clever. There you are, slaving away at this program and it suddenly dawns on you that by using just one or two of the extended BASIC commands or functions you could replace virtually your entire program with a subroutine!

In order to save you all innumerable sleepless nights of frustrated coding we've collected a few of the clever little ideas that have passed our way over the last year and compiled them into a collection for you to take advantage of. So, if you want to pick up some useful tips on the Beeb pick up a copy of the next issue!

Articles described here are in an advanced state of preparation but circumstances may dictate changes to the final contents.

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Simon Goodwin

PASCAL PROFILE

Our new series on programming in Pascal starts off by looking at some of the fundamental differences between it and BASIC and introduces some simple structures.

If you own a microcomputer you probably program it in BASIC or machine code. Each method has its advantages — BASIC can be written and tested very quickly, while machine code takes a long time to develop. In turn, once you have written a machine code program it will run very quickly — perhaps fifty times faster than the equivalent BASIC.

Machine code and BASIC are probably the two most popular microcomputer programming languages, but there are dozens of others. Earlier this year *Computing Today* presented a series on the FORTH language, which falls midway between BASIC and machine code in its speed of programming and execution. Another language used by quite a few programmers is called Pascal, named after the French scientist and philosopher who invented the first mechanical calculator in 1642. In this series of four articles we will explain some of the differences between Pascal and the most popular languages.

In the last couple of years lots of angry letters and articles have been printed about programming languages. Some people argue that their favourite language is better than other ones, and they are usually right! A programming language is just a way of communicating instructions to a computer, and nobody would bother to make up a new one unless they felt that they could do something better. To the hobbyist it shouldn't really matter which language is 'best'. The vast majority of us program computers because it is fun, and the language we use doesn't really affect that. Likewise we program computers because we enjoyed learning to do so — otherwise we would have given up.

A SHORT HISTORY

The language Pascal is based on a series of languages named ALGOL (which stands for ALGOrithmic Language). The first popular version of ALGOL was released in 1960, and consequently it was named ALGOL 60. A few years later users made up a list of all the things that ALGOL 60 wouldn't do, and designed a new language called ALGOL 68. This was an excellent idea, and the details of the new language were published in good time so that all the various computer manufacturers could write standard copies of ALGOL 68 for their computers. The snag was that ALGOL 68 was a rather complicated language. 1968 came and went and nobody had made ALGOL 68 work on their machines. Since then various companies have produced 'versions' of ALGOL 68, but nobody has yet issued the entire language!

ONE MAN'S LANGUAGE

One of the people who was responsible for the planning of ALGOL 68 was an Austrian programmer named Niklaus Wirth (pronounced 'Wurter'). As the specification of ALGOL 68 grew more and more complex Wirth became less confident in the project and eventually he produced his own version, called ALGOL W. That language was fairly popular and Wirth was encouraged to develop a further language. In 1968, while the ALGOL 68 people were still trying to fit a quart into a pint pot, he announced Pascal, a miniature version of ALGOL W designed to run on small computers. It had a number of new features dreamt up to make it more useful than ALGOL W, and by 1970 Wirth had a working version of the language.

A few years later Niklaus Wirth started to invent another language (called 'Modula') — it will be some years yet before the success of that project can be assessed. In the meantime more and more programmers have become interested in Pascal, and there are now versions available for small computers such as the Commodore PET, the Apple, Sharp MZ-80K and even a £15 'Tiny Pascal' for the 16K TRS-80. Acorn Computers have announced a version of Pascal that will plug into the BBC micro, and there is no fundamental reason why a small Pascal system should not be run on a 16K ZX81 or Spectrum.

With so many cheap versions of Pascal about it seem well worth learning the language purely for fun. If you use all the functions of BASIC you should have little difficulty learning Pascal, and you might even like it! This series was written by a programmer who was a confirmed BASIC and machine code addict until a year ago. I used to gnash my teeth and growl under my breath when I read the letters calling BASIC a rotten language. I still use BASIC a great deal, but if I come across a problem that would be easier to

solve using Pascal, that's how I tackle it. Pascal isn't really better or harder than other languages — it is just different.

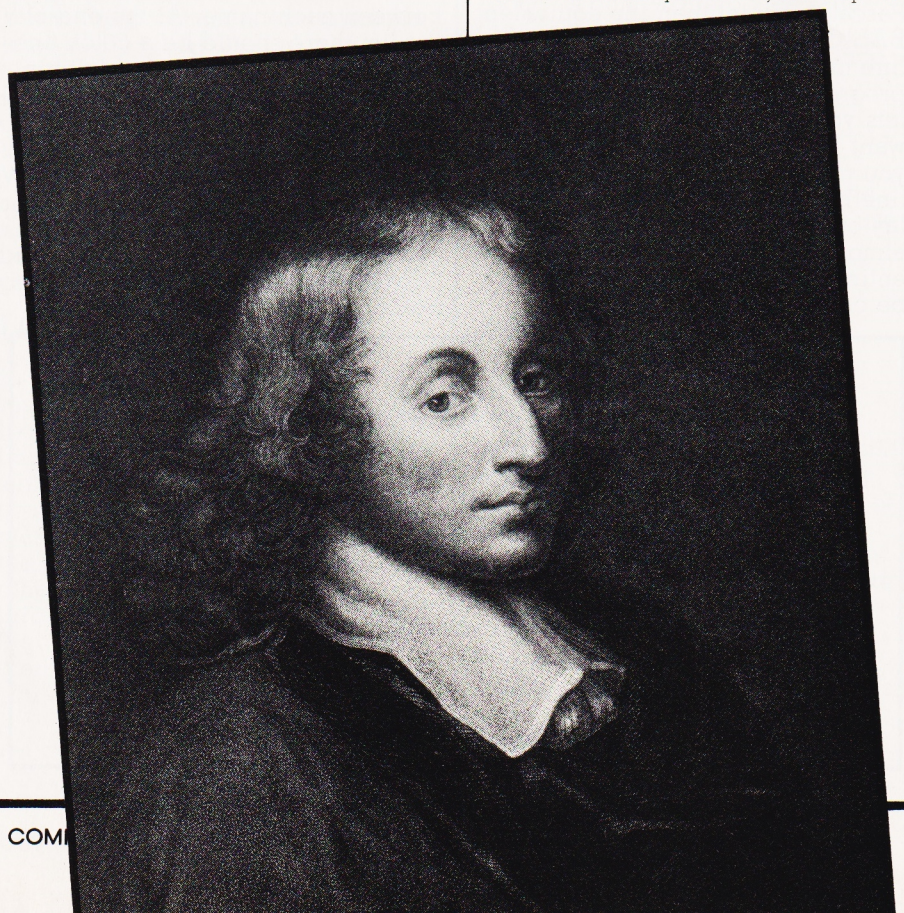
Example programs in this series will be written in Standard Pascal. They have been tested on a Video Genie using the excellent Pascal-80 system from Microcomputer Applications, but they should run without major modifications on any full-sized Pascal system.

WHAT'S NEW?

Unlike BASIC, a Pascal program cannot be executed as soon as it has been written. You write your Pascal using English words and mathematical expressions like FOR, SIN(X*2), END and so forth, and the meanings of the words are similar to those in BASIC, but the words have to be translated into machine code before they can be executed. When you tell BASIC to run a program it scans through the instructions that you have typed. Once it finds a symbol that it recognises, BASIC works out what you want it to do and then calls up a routine to do the job. The effect is that the words you typed are 'interpreted' while the program is running. If your program executes the BASIC line I=I+1 a hundred times, each time it does so BASIC has to work out whether I is a variable or a statement, find the variable I in a table of values, convert the number 1 into binary and then add the binary value to the number stored under the name I.

Pascal programs are not interpreted in that way as they run. When using Pascal you type your program and then use a utility called a 'compiler' to convert the symbols and English words into some form of machine code. The compiler scans through the Pascal text, finds that I is a variable and works out a fixed place to store it. It replaces the number 1 with a binary value, and then makes up some instructions that will cause the computer to get the variable from its place in memory, add 1 to it, and put it back. Once the program has been translated it is almost impossible to tell what the original English word instructions were, so compilers usually keep a copy of the Pascal program text, called the 'source', and generate a separate set of instructions in machine language, called the 'object'. If you program in assembly code you will probably be familiar with this idea — assembler instructions like RET and JSR are source text, and codes like E9 or 20 are the hexadecimal object code. If you have never mastered assembly code don't worry, you should never need to examine the object code of a Pascal program — just execute it when the need arises!

The effect of all this translating is that it is easier to alter a BASIC program than a Pascal one. In BASIC you can type in a line without a number and the computer will execute it immediately, this is not possible in Pascal. If you want to change a line in BASIC you can just stop the program, type it in and run the new version. A Pascal programmer would have to stop the program, load the source code, make the change, re-compile the entire program, and then run it again from the start. A typical Pascal program on a microcomputer can be compiled in about one minute, and many compilers allow you to store the source and object of a program in memory at the same time. This means that while you are testing a Pascal program it will probably take up rather more memory than the equivalent BASIC, but once you have finished modifying the Pascal you can discard the source code, usually leaving a program smaller than the BASIC equivalent. The compiled Pascal will run much more quickly than the equivalent BASIC — on average, between five and 10 times faster. That is because the computer spends less time searching for information and converting it from text to binary form.



GETTING STARTED

Pascal systems seem rather complicated at first. Before you can run a program you need a text editor (so that you can enter the source), a compiler (to generate the object code) and probably a monitor to help you get from one to the other. In fact BASIC uses a very similar system, but you don't notice it so much. BASIC contains an editor, which takes the lines you type and stores them in numeric order. The BASIC editor also recognises commands like LIST and DELETE which enable you to examine and modify your program. When you type RUN or enter an immediate command like PRINT "HELLO" BASIC uses an interpreter to execute what you have typed. A monitor routine looks at each line entered to decide whether the editor or the interpreter should deal with it. Some versions of Pascal work this way but most don't — if yours doesn't, don't let it worry you because it won't really make any difference. The snag is that the designers of Pascal only specified how the compiler should work, and consequently monitor and editor commands tend to differ from one machine to another. Any reputable Pascal system will be supplied with instruction about the non-standard commands.

You probably found that you couldn't really get the hang of BASIC programming until you had access to the computer. Similarly Pascal can best be learnt by ▶

actually using the language, so if you have not yet got a Pascal compiler, go out and get one. Cheap 'introductory systems' are available for most of the popular computers, so you shouldn't need a disc drive or a mortgage to get started.

A PROGRAM TRIVIAL

Figure 1 shows the listing of a

```
PROGRAM TRIVIAL(OUTPUT)
 (* A VERY SIMPLE PASCAL PROGRAM *)
BEGIN
   WRITE('HELLO')
END.
```

Fig. 1. A complete Pascal program.

Pascal program. Please excuse the simplicity of the example, since even such a trivial program reveals many of the principles of the Pascal language. The first line is the program heading, and has a slightly varying syntax depending upon the version of Pascal that you are using. In general, the word PROGRAM is used to indicate the start of the Pascal code. The word immediately after that is the name of the program, and then follows a list of all the input and output devices used by the program, enclosed in brackets. These 'devices' are just places where the program can send information — either filenames or the standard identifiers 'input' and 'output' which are normally routed to the keyboard and display of your micro. The heading is not required by 'Tiny Pascal'. The list of files is ended by the ')' symbol, and then the Pascal 'separator', a semi-colon. That marks the end of the heading.

The second line of the Pascal program is a comment. These can occur anywhere in a Pascal program except in the middle of a word, so you could have:

```
PROGRAM TRIVIAL
((* SCREEN DISPLAY *)OUTPUT);
```

if you wanted. Comments can contain any text except '*)' which marks their end. They can run over from one line to the next if need be. The start of the program code is marked by the word BEGIN, which can be thought of as a '(' bracket. The END on the fifth line acts like a ')', so the effect is that the program is enclosed in a pair of brackets. There is only one program statement there — the line WRITE('HELLO') corresponds to a BASIC PRINT"HELLO"; — note that the WRITE statement does not move the cursor to the next display line automatically, as a BASIC PRINT without a semi-colon would. The word WRITELN (short for write line) is used if it is required to move to the next line after text has been written. Pascal uses single inverted commas rather than double ones to surround text to be output. In Pascal terminology WRITE is a 'function' so the values it uses are enclosed by brakcets.

The last trick up the Pascal sleeve is concealed right at the end (or the END) of the program. When the compiler comes to the sequence END followed by a full stop it stops compiling. The full stop marks the end of the source. You may find that compiler manuals refer to 'case conventions'. Some books refer to capitals as 'upper case' and small letters as 'lower case' — this is a hangover from the days before computer typesetting, when books and newspapers were produced by machines that assembled lines from cast letters made of lead alloy. The machines store letters to be typeset in two 'cases' one above another. Pascal doesn't usually mind whether you type programs in capitals or small letters or a mixture of both. Examples in this series will be presented all in capitals.

At this point I can hear some of you grumbling that this must be a rather crummy language if it takes five lines of Pascal to do the same as an immediate BASIC command. You are right about the length in this case, but Pascal can't really be judged upon its ability to display a single word! In the long run it takes no longer to type a Pascal program than the equivalent BASIC. For a start, Pascal has no line numbers. You type in your program using a text editor that lets you insert lines wherever you want to, and, most amazing of all, you never need to refer to a Pascal line by a GOTO! In fact you can lay out your Pascal programs almost any way you like — the entire program in Fig. 1 could all be on one line if you wanted to type it that way — alternatively you could put ('HELLO') on the line after the WRITE statement, or even put the brackets on lines of their own if you wanted to. The only rule is that you must have at least one space (or the end of a line) between each word such as PROGRAM and the name 'TRIVIAL', and you mustn't break words between lines or put spaces in a word.

ADDING TO THE PROGRAM . . . ?

The program ADD in Fig. 2. indicates the use of variables in Pascal. The heading indicates that this program uses input and output, and consequently the compiler must include routines to handle both in the object code. Variables are declared after the heading. In BASIC if you use a new variable name the interpreter will automatically add it onto the table of current variables. On the BBC Micro the BASIC interpreter only lets you use a variable if you have previously given it a value, so that you don't mistype a name and have a new variable 'created' by the interpreter when it is found on the right-hand side of an equals sign. Other BASIC interpreters will set up a new variable and give it the value zero. A few machines (including the Acorn ATOM) will set up the variable and give it a totally random value if you forget to set it yourself before use!

The word VAR tells the Pascal compiler to expect a list of variable names. The list can be any length, and there should be a comma between each name. At the end of the list there should be a colon and then the name of the variable type. In Pascal if you want to store text in a variable you don't need to put a dollar symbol after the name — you just declare the variable as being of type CHAR (for character). Likewise variables containing whole numbers only (integers) don't need a trailing percent (%) symbol. Instead they

```
PROGRAM ADD(INPUT,OUTPUT); (* GET AND ADD TWO NUMBERS *)
VAR NUM1,NUM2 :INTEGER;
BEGIN
   WRITE('PLEASE TYPE TWO NUMBERS');
   READ(NUM1,NUM2);
   WRITELN;
   WRITELN('TOTAL IS ',NUM1+NUM2)
END.
```

Fig. 2. A Pascal program using variables.

are declared as type INTEGER. Next month's article will deal with data types in greater detail. Anyhow, in this program we have announced that we want to use two whole-number variables called NUM1 and NUM2. If this were a more complex program we might put a comment by the name of each variable, explaining its use. Notice that in Pascal you can use fairly meaningful names rather than AA$ or B1% as in most versions of BASIC.

The program is once again bracketed by the words BEGIN and END. The Pascal READ function works in a manner similar to that of the BASIC INPUT — it reads data into variables specified in a list. As usual the names are separated by commas in the source. When you are typing data into a Pascal program you don't need to put a comma between numbers if you want to enter more than one. Any character that is not a number will do — a space, for example. The semi-colon separates the READ statement from the WRITELN on the next line. WRITELN is the equivalent of PRINT here — it moves the cursor to the next display line. Once again a semi-colon is used to separate the WRITELN from the line that displays the answer. The WRITELN or WRITE functions can be used with any number of data items, in much the same way as can PRINT in BASIC. Each item must be separated from the next by a comma, and printed immediately after the previous one — hence the space at the end of "Total is". When the program is executed the total VAR1+VAR2 is calculated and output, just as it would be in BASIC. Note also a difference between Pascal and BASIC — there is no semi-colon after the last WRITELN. Semi-colons in Pascal separate one statement from the next, and since END is just a bracket marking the end of the program, no semi-colon is needed.

LOOPING THE LOOP

In BASIC the main looping instruction is the FOR...NEXT loop. The FOR statement marks the beginning of the loop and declares which variable will be used for counting the steps. The NEXT part marks the end of the loop, and all the code between one and the other is executed at each step through the loop. Hence to print the numbers 1 to 10 in BASIC and then signal that you have finished you might use:

```
FOR I=1 TO 10:PRINT I;
:NEXT I:PRINT "DONE"
```

```
PROGRAM TABLES(INPUT,OUTPUT); (* WORKS OUT TABLES *)
VAR TABNUM,COUNT:INTEGER;
BEGIN
   WRITE('WHAT TIMES TABLE WOULD YOU LIKE ? ');
   READ(TABNUM);
   IF (TABNUM>0) THEN BEGIN
      FOR COUNT:=1 TO 12 DO BEGIN
         WRITE(COUNT,' X ',TABNUM);
         (*THESE LINES ARE DELIBERATELY SEPARATED SO AS
         TO ILLUSTRATE HOW BEGIN...END BRACKETS WORK*)
         WRITELN(' = ',COUNT * TABNUM)
      END; (* OF THE FOR LOOP *)
      WRITELN('THE ',TABNUM,' TIMES TABLE.') (*CAPTION*)
   END (* OF THE THEN BRACKET *)
   ELSE WRITELN('DON'T BE RIDICULOUS!')
END.
```

The Pascal program TABLES illustrates the basic structures covered this month.

In Pascal the loop would be written in a very similar way. Ignoring the need for a program heading and variable declaration you could enter:

```
FOR I:=1 TO 10 DO WRITE(I);
WRITELN('DONE')
```

Note that Pascal uses ':=' (read as 'becomes') instead of '=' when assigning a value to a variable. This seems a bit odd at first, but it soon becomes second nature. You probably once found BASIC lines like 'I=I+1' rather odd! The example above illustrates another important Pascal idea. Only the first WRITE above is controlled by the FOR instruction. The word 'Done' is only written once, after the loop has finished. If you wanted to write it more than once, as in the BASIC line:

```
FOR I=1 TO 10:PRINT I;
:PRINT "DOING":NEXT I
```

you could put a 'bracket' around the two WRITE statements and use the Pascal:

```
FOR I:=1 TO 10 DO
BEGIN
   WRITE(I); WRITELN('DOING')
END;
```

(of course you could really put the two WRITEs or PRINTs together, but that would defeat the object of the example!).

A full Pascal program to print an arithmetic table might look like this:

The program TABLES is very simple in principle, but it gives us some insight into the idea of BEGIN and END as brackets. The IF...THEN statement works in a similar way to BASIC — the instruction after the THEN is executed if the condition tested is true. In 'TABLES' the instruction after the THEN is a BEGIN, so all the statements between that and the next END are bracketed together. There are two statements inside the THEN BEGIN section — the FOR and the caption. In turn the FOR uses another BEGIN...END bracket to enclose the two lines which print the table. The listing is 'indented', which means that some lines have spaces at the start. That makes it easier to tell where the BEGINs and ENDs are in the program. There must always be an equal number of each, or the program will not be compiled successfully.

The Pascal IF...THEN instruction allows you to specify an ELSE part. If the test after the IF fails then Pascal skips over all of the THEN instructions and on to the instruction after the ELSE. In this example, if you select a value of zero or less for tabnum the computer will print a scolding message. Note also that the program skips over the ELSE instruction if it has just executed the THEN part successfully.

SO FAR...SO GOOD

This month we have covered some of the features of Pascal that closely resemble BASIC. We've also looked at the idea of bracketing sections of code together — probably the most difficult idea to get used to when you learn Pascal after BASIC. Next month we will look at one of the most powerful aspects of Pascal — data typing — and we'll learn a few more Pascal instructions.

Software News

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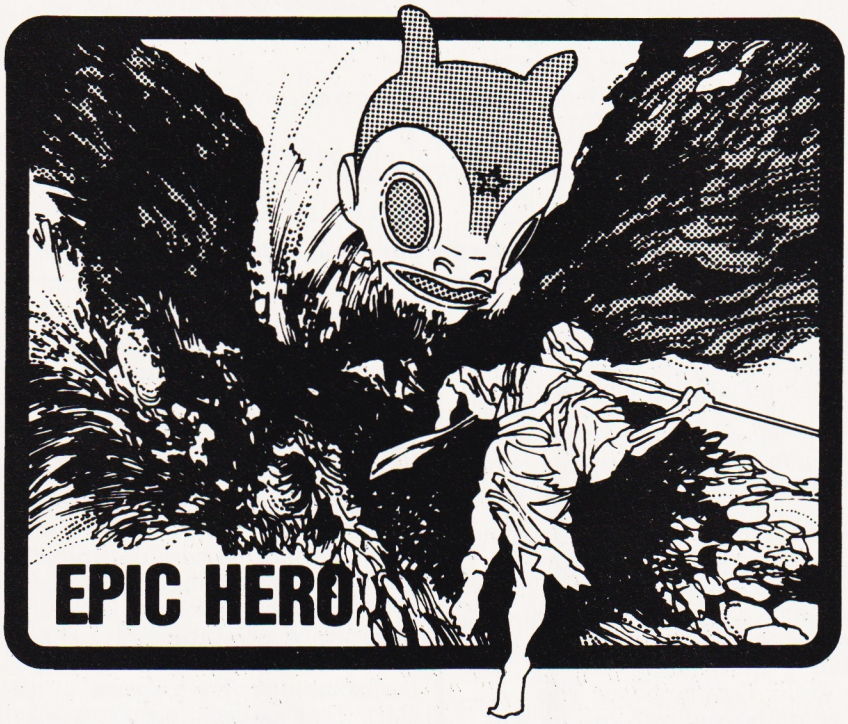

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The game may be customised; a terrain editor is included in the package and in this way, the landscape, number and positions of the missiles and radar bases can be changed by the user. Excellent graphics and, of course, sound. Compatible with all Genies and the Model I and Model III TRS-80.

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To play Strike Force you will need skill, cunning, fast responses and a keen sense of strategy. Most people find it more taxing than Penetrator and the "preview" of advancing forces is certainly one of the key features of the game. It does, of course, have sound. Both Strike Force and Penetrator are published by Melbourne House, an Australian Company. Strike Force is compatible with all Genies and the Model I and Model III TRS-80.

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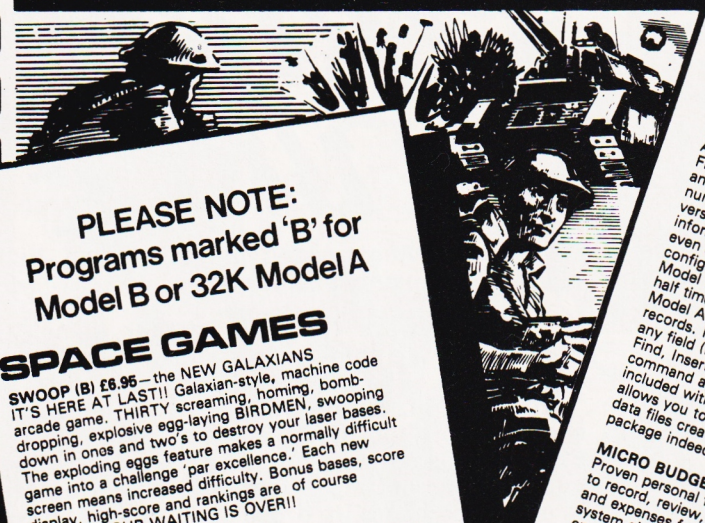

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Paul Kriwaczek

VIEWPOINT

This month's opinion piece is based on the text of a speech delivered by the author at Microfest '82

The subject on the agenda is Computer Literacy. But before I say anything else, I am going to argue wth the use of that term itself. Computer Literacy is an awful phrase, but it's typical in many ways of the misuse of words of which the computer world in general and above all, the world of microcomputers, is particularly guilty.

Another prime example I am sure you will have come across, is 'Hands On'. It's only an ugly way of saying 'practical'. When I was asked to undertake the production of what later became ***'The Computer Programme'***, the title of the series was given to me as 'Hands On Micros'. They couldn't understand why I thought that was both funny and vulgar. I told them that it reminded me of the well-known story about the school Shakespeare play dress rehearsal, when the drama teacher said that he wanted everybody in costume. "The girls," he said, "will wear their Elizabethan dresses, and the boys will all wear tights". "Please sir," pipes up a small boy at the back, "even those of us with small parts?".

SEMANTICALLY SPEAKING

I am just a little worried about handing over control of our future to a technology designed by people who think that 'Hands On Micros' is a suitable title for a television

Well, as you know, that's not the title the series ended up with. But the whole project is still called The Computer Literacy Project. And, even though the term is neither vulgar nor funny, in my opinion it is still a solecism — an incorrect use of words. If literacy means anything at all, it means a knowledge or understanding of 'litera' — letters. In other words, the ability to read and write. Computer literacy should, therefore, mean the ability to read and write using a computer. I don't think that is the way the phrase is commonly employed.

I am not just quibbling with the expression for the sake of pedantry. Nor am I taking the attitude of the well-known comment made at the time of the first introduction of the new medium, television: "No good can possibly come of an invention, the name of which is composed of the bastard combination of one Greek and one Latin root".

The reason I am making difficulties over the phrase is firstly that the misuse of words is intended to suggest that an understanding of computers is as vital today as the introduction of real general literacy was in the nineteenth century, and secondly because the confident use of the expression obscures the fact that nobody actually agrees about what it means.

So, what I would like to do is question whether it does mean anything in the first place, and if so, what. And whether we really need it anyway. I haven't got any firm answers for you, just questions. But they are questions which, in my view urgently need to be asked.

TECHNICAL ENQUIRIES

It took me over a year of learning the computer business before I felt able to make any suggestions at all about what approach to take towards the television series. I then made a pilot programme which was tested by showing it to selected groups of the general public. As a result of their reactions, we made many changes, both in style, format and content. In fact ***'The Computer Programme'*** remained a fluid idea right up to the last possible moment. We didn't finally commit ourselves until some six weeks before the first programme was due to be recorded.

Nonetheless, from the very beginning we were barraged with articles in the technical press, suggesting that what we were doing was wrong. In fact, it soon got to the stage where I was tempted to write back saying: "If you already know what we are going to be doing, please tell me because I don't".

The two major camps vieing with each other were those who endorse computer awareness as opposed to those who support a more functional skill-based approach. The skills group range from the ubiquitous 'learn to program in BASIC' brigade, found in schools and clubs on the letter pages of the enthusiast magazines, or loitering innocently around the Sinclair ZX81 display at branches of W H Smith, whistling. And the moment the sales assistant's back is turned, in they go for a quick program! They are the merry band responsible for most of the really offensive mail that arrives on my desk every week.

Of course not everybody writes to me. Some 'phone me at any hour of day or night. I have in mind one particular chap who is convinced the only worthwhile computer literacy is an understanding of digital electronics. The poor fellow has been ploughing his lonely furrow with every broadcasting organisation in the British Isles. I'm afraid I let him down too. There wasn't a single mention anywhere in my series of TTL, ▶

CMOS or transistorised totem pole circuits.

But the skill based approach does not invariably include any understanding at all. From the beginning we were under pressure from some areas of the educational world, to avoid explanations of any kind and concentrate on practical use. The vast majority of the public who will have to use computers, these teachers say, will need to know how to operate them, not to understand them. And this is a widespread view in the mainframe computer industry too. If I have heard the motor car analogy once, I've heard it a thousand times — 'you don't have to understand anything about the internal combustion engine to drive a car'. The only thing computer users really need, say these people, is keyboard skills. Never mind how it does what it's doing, the only real question is how do you get it to do it. But the advocates of the various skill-based approaches don't have everything their own way. The awareness group has quite a lot of clout too, particularly since behind them stands the power of the DOI and the DES, the Scilla and Charybdis of computer literacy.

THE CHIPS ARE DOWN

Ever since the Horizon programme *'Now The Chips Are Down'*, the government has been terrified that Britain is going to be left behind in the international race to computerise. And, no surprise, it turns out that the manufacturers are keen to play their part too, in making sure that potential consumers are alerted to the treasure house of electronic goodies available on the market. In fact, where only Clive Sinclair dared to tread up to now, others are waiting to follow. I see that Binatone, at the cheap end of the market, are about to launch their less-than-£50 personal computer. Doubtless there will be others too. For them, computer literacy means knowing what is available on the market, first of all in terms of hardware and then of the software packages without which no home of the future will apparently be complete.

But there is another group, for whom awareness means something completely different. People like journalist Malcolm Peltu, Jeff Taylor and others are concerned above all about the social effects of the introduction of this new technology. For them, computer literacy means understanding the power of Information Technology to radically change our way of life. By understanding their potential, so the argument goes, ordinary people will be able to control the way computers are introduced into our world and thereby command the direction of the information revolution.

You'll notice that all these conflicting groups share certain common assumptions. First, that computers are going to play a large part in everybody's life in the future: at work, at play, at home and at school. And second, that a drive for 'Computer Literacy', however defined, is very important.

And I find this rather strange. Because I can think of no other technology that was ever introduced with such fanfares and alarums, which spawned courses, conferences and seminars and the insistance of the government of the day that every school should possess at least one example of the new machine.

The internal combustion engine was probably as important an invention in its time as the computer is today, and so was an electric motor. Both of them have profoundly influenced all our lives. The fractional horsepower electric motor is one of the most pervasive components in all of industry. But when they were first introduced, it was assumed, and quite rightly, that if these things had advantages to offer, they would be put to work quickly enough.

We didn't have an electric-motor literacy project. There was not, as far as I know, a government department set up to ensure that the British businessperson used internal combustion engines, that the British schoolchild studied them and that the British consumer purchased millions of pounds worth of them. It is true that today our motorcar industry is in disarray, but surely nobody would suggest that the cause is public ignorance of the technology.

So why are computers different? Why is it necessary to invoke the emotive phrase 'literacy'? Why is it that without enormously expensive publicity campaigns, the public is apparently unable to see the benefits that computers can bring? "Britain, which helped pioneer computers and IT, is lagging behind" cries the DOI in its advertisements. "Fewer than 50% of our industrial and commercial concerns make any use of them". What is the overriding urgency felt by government and others which makes them behave like missionaries bringing us the gospel, the good news?

FAITH HEALING

Could it be that the answer is faith? That our problems now seem so insoluble that a technological answer is the only possiblilty and that, as the latest technology, it must be computers which will bring salvation? The perfect example of a solution desperately looking for problems to which it can be applied?

It certainly seems like it. Reading and listening to the publicity, one is given the undeniable impression that the computer and Information Technology are going to solve all our problems and cure all our ills. Britain may be in difficulties today, but come the computer revolution, everything is going to be all right. The problems of health, of education, of the environment, of industry, of leisure, will all fall like ninepins beneath the wheels of irresistable progress; as long, that is, as we embrace the philosophy of the computer and do not drag our feet.

"This is an opportunity we cannot afford to miss," proclaim the Department of Industry, "the survival of all industrial nations depend on their adoption of IT". And we see the Minister for Information Technology touring the country, like some Bible-thumping evangelist.

And the experts play their appointed part too. Nit-picking theological arguments appear in the letters pages of the computer magazines and even the daily newspapers. First there was BASIC which broke the stranglehold of the high priests in the temples of Data Processing, and brought computers to the people. But in the reformation of the seventies, BASIC was found to be a currupting influence. Those who used it apparently became prey to bad processing habits and so would never sit at the right hand of Charles Babbage. The Dutch purist Professor Djikstra pronounced that the use of BASIC had put computing back twenty years; although whether he nailed his protest to the doors of Dartmouth College, where BASIC was created, I don't think history records.

So now, austere new languages like Pascal have their following and are committed to eradicating the decadent self indulgence of BASIC. They are much more difficult to learn and to use, but they impose discipline and

obedience. After all, nobody ever suggested that the pursuit of the millenium was to be an easy option.

And the millenium it is apparently to be — with no limits to what is possible. Forget the simple practical demands to which information technology obviously does make an important contribution. Aids for the handicapped are a good example. Information storage and manipulation for business is clearly of great use. The number-crunching power of the computer is an invaluable aid to science.

But these mundane affairs are peripheral to the really grand vision. The adherants of computer power have much more in mind. I quote Clive Sinclair: "The day will dawn when computers will teach better than human beings, because they can be so patient and so individually attuned. It will replace not only the Encyclopaedia Britannica but the school".

But Charles Lecht, chairman of Advanced Computer Techniques Corporation in New York is there already: "You know, I really believe that machines can do everything better than people".

And now the Japanese are putting the full power of their centrally directed industry into producing the so-called 5th generation computer system, which is intended to be a thinking, listening, speaking machine with intelligence equal to or greater than that of people.

COMPUTER HERESY

The extraordinary thing about all this is that, like other faiths, it is never to be questioned — that would be rank heresy. No one is supposed to ask precisely which problems the computer is supposed to solve and how it will solve them.

Not that we don't have problems which urgently need attention. Our society is not exactly in a very healthy state. But what we suffer from seems to be more to do with our alienation from each other and from nature, from the decay of our institutions and the corruption of our environment, and from the rampant materialism of our ruling philosophy. It never occurred to me that our difficulties are caused through the insufficient application of technology.

Nor do I think that, as far as education is concerned, Clive Sinclair has the answer. Tuition by computer, far from being an advance, would take us right back to the rote learning of the Victorian schoolroom, with its emphasis on convergence and conformity, and penalising originality and imagination, human traits which no computer yet envisaged could cope. In any case, an approach which doesn't recognise the true problems — the alienation, the anomie and purposelessness felt by so many children and the divisive nature of the present system — stands no chance whatsoever of contributing an improvement to the situation.

But paradoxically, this is, in my opinion, the very reason why a familiarity with the basic concepts of computing is so important. If I criticise the expression Computer Literacy, I still wholeheartedly endorse its purpose. After all, it's not all that difficult to understand something of the way in which computers work, even children can do it with ease, and that understanding is an important form of protection.

But in fact, with most things, at least we have an inkling of the basic concepts involved. And this is where the motor car analogy falls down. It is simply not true that one doesn't need to know how the internal combustion engine works in order to drive a car. It merely depends on what one means by 'knowing how it works'.

If somebody tells us that they have a car which can travel 400 miles per hour, we might just perhaps believe them. If they claimed that their car can fly to New York in three hours, we would just laugh. But who laughs at Clive Sinclair's claim that the computer will make the school obsolete. Who laughs when computer experts suggest that in the future, computers will make business decisions, will write novels, will compose music, will even abolish war. All too often these absurd claims are believed.

An understanding of the essential nature of computer operation would allow people to make their own judgement of the value of such claims, and of the value of computer results too. And that is a matter of urgent practical importance, particularly if and when the Japanese produce their 5th generation systems.

ELIZA DOES LITTLE?

One of the major trends today in the design of computer systems is to hide the nature of the operation. The process should ideally appear totally transparent. The user should be unaware of what the machine is doing in order to produce its results. To this end, there is a strong drive towards what is called non-procedural languages — like PROLOG. These are languages in which you simply inform the computer of the results you require and not, as in BASIC, how to arrive at them. Artificial intelligence is to be applied, so that the computer will seem to understand the user's request. A plausible human-like response is aimed at; the computer will answer a request almost as if it was another person.

Quite a long time ago, Joe Weisenbaum, Professor of Computer Science at MIT, wrote a program called Eliza. This was a conversation generator which used a number of relatively simple programming tricks to create apparently suitable replies to statements entered by a human user. Eliza could be supplied with a vocabulary derived from a number of limited domains of interest, and the most well-known was one called Doctor. This was based on the art of the psychoanalyst and made the computer produce responses that rather accurately mimicked what you might hear when lying on a couch, talking about how you hated your mother.

Weisenbaum wrote the software to show how easy it was to produce stereotyped conversation. He was horrified when people who had used the system seemed to get genuine satisfaction from the phony exchanges and started to claim that the machine 'really understood their problem' and even more so when orthodox psychoanalysts asked if they could use his program as a therapeutic aid.

JUDGEMENT DAY

It is to be able to judge ideas like these, each in our own field of technology, that we all need to have a basic understanding of what Information Technology is and how it functions. Not necessarily in any detail, but enough to know that a computer is a device for storing information in symbolic form and manipulating it according to a number of simple mechanical rules.

By understanding that, we will be in a better position to judge the value of what computers can do for us and to decide where their use is appropriate and where it is not. It is, if you like, a way of having our cake and eating it too. If that is what they mean by computer literacy, then so be it. I am all in favour even though I still don't like the phrase.

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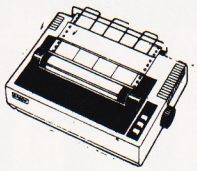

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PEEK AND POKE EXPLAINED

If you've ever wondered about the way in which simple moving graphics can be achieved you'll need to know about PEEK and POKE.

If there was ever a pair of BASIC keywords that had generated more questions about their purpose by users of micros then I've yet to meet them. Each month the post is almost guaranteed to bring a couple of letters from anquished readers trying to unravel the apparent mystery of these two commands. As the toll of letters has steadily mounted it has become more and more obvious that it is time that the mysteries were unravelled once and for all.

The purpose of these articles is to take a close look at just how PEEK and POKE operate and what the programmer can do with them. First, however, it is necessary to define just what functions they perform within a program.

IN PLAIN WORDS

Although the functions of PEEK and POKE are complimentary they are different in structure. The keyword POKE is classified as being a command while PEEK is a function, the difference being that the former performs an action while the latter recovers a value.

The command:

```
POKE x,y
```

will cause the computer to substitute the decimal value y for whatever is currently held in the memory location whose decimal address is x. The key to the whole thing is the use of the word memory because that is what makes these two keywords so powerful. Indeed, they are the only method generally available to the BASIC programmer which enables him or her to alter the contents of specific memory locations.

As I previously mentioned, PEEK is actually a function and not a command and so it is necessary to use it in the form:

```
LET y=PEEK(x)
```

I have left the LET statement in simply for clarity, it is virtually redundant on most micros (with the notable exception of Sinclair's machines). The short piece of BASIC above will inspect the contents of the memory location whose decimal address is x and return a copy of these contents (in decimal) which is then assigned to the variable y.

OF MEMORIES AND MAPS

By now you will have realised that we are interested in altering memory locations or inspecting their contents. There are three main areas where the ability to perform these operations becomes crucial. Firstly we have simple graphics displays, whether for games or serious purposes. Our second area is machine code programming and accessing systems software from a high level language, in our case BASIC. Our third and final area or interest is that of Input/Output and the control of hardware both internal and external to the system on which the program is running.

This month I am going to look at just the first area of application, the others deserve separate coverage which will be published in a later issue. In order to be able to use PEEK and POKE to create graphics displays we require that our computer be equipped with two things; a memory mapped display and a set of characters and symbols that can be addressed by number. Virtually all of today's common micros have these items but it is worth pointing out that the following examples will not immediately work on the ZX81, it doesn't have a conventional memory mapped display, or the BBC Micro and the ZX Spectrum, these have bit mapped displays rather than byte mapped displays. If we accept these limitations then you should be able to make use of the following examples on most other systems provided you follow the text carefully.

The relevance of the word 'map' when used in conjunction with memory often seems to produce blank looks, quite why I have yet to understand. A micro of the eight-bit kind (as found in most common systems) possesses 16 address lines which enables it to address some 65,536 bytes of memory. Now, certain areas of this are reserved for the BASIC interpreter, others are reserved for the operating system or monitor, a small area is usally kept for I/O and the rest is available for the user. However, it was realised very early on in the history of micros that it was quite simple to reserve a section of the memory and use this as a basis for the screen display. In other words, every character position on the screen corresponds to a memory location held somewhere within the computer.

Now, the overall plan of the way that the memory has been allocated is called a memory map and somewhere on this map, which should be in your manual, you will find that an area is allocated for the screen. Table 1 gives the relevant areas for a selection of systems.

HAVING A GO

The quickest way to start you off on the road to understanding memory maps and how to manipulate the information in them is to provide a short demonstration. First, find the values for your computer in Table 1, if they aren't there try looking it up in the manual. Now, pick a value that is approximately halfway between the two numbers given. This value will be the address which we are trying to access. Now select a second number between 1 and 255 which will be the code of the character which we wish to appear at this point. It cannot be bigger than 255 because the largest value a single byte of memory can hold is FF Hex or 255 in decimal. For the purposes of our experiment let us select the value 42, not just because it is the answer to Life, the Universe and . . . but because it usually produces a '*' or asterisk character!

Now, type the following into your micro, no line numbers are needed.

```
POKE x,42
```

where x is the memory location you have selected to be somewhere in your screen memory. At this point ▶

one of three things will happen. Hopefully, if you have picked the numbers correctly, a '*' will magically appear somewhere on your display. If this doesn't happen but some other character appears instead don't worry too much at this stage. The third option is that nothing happens at all. In this case there are two possible answers to the problem, one is that you've miscalculated the address and POKEd your character into the depths of the system and, secondly, that you calculated correctly but your system suffers from a non contiguous screen map. Both these problems can be solved! A point of warning at this moment would not go amiss. I once wrote in an article that you could POKE quite happily to any address anywhere in any system without damage being caused; wierd things may well happen like the system locking up, but no damage. Well, if you have a Commodore 4000 series machine, that's a PET with a 12" screen, or an 8032/8096 machine ***don't POKE anything to location 59458*** as certain values will have a disastrous effect on the VDU.

BOXING IT IN

The first demonstration program is stunningly trivial, it simply draws a box around the screen! Now, at this stage I should reveal that all these programs are written on a Sharp MZ-80A, simply because it happened to be on my desk at the time and is a very typical example of a memory mapped system. (Note that the graphics are in MZ-80K mode so remember to press Control □ first!). The second admission is that the conventions I'm going to use were first introduced by Trevor Lusty in his Interactive Graphics series (*Computing Today* November 1980 to January 1981). The conventions are as given in Table 2.

At this point I will assume that you have loaded the program given in Listing 1 into your computer converting the variable values were necessary. The program first POKEs an asteriesk (code 107 in our case, not 42) to the top left-hand corner of the screen and then continues placing asterisks across the top line until it reaches the right-hand top corner, lines 40 to 60.

Now, asterisks will descend from the top left-hand and top right-hand corners until the lines reach the bottom corners of the screen, lines 70 to 90.

Finally, a row of asterisks will be POKEd in from the bottom left-hand corner to the bottom right-hand corner, lines 100 to 120. Simple really, isn't it!

HERE'S LOOKING AT YOU

So far we've only looked at the POKE command so perhaps it's time we saw what can be done with PEEK. If we create a random scattering of asterisks on the screen, say 50, how would we go about finding them? Well, as we know, the PEEK function allows us to inspect the contents of any memory location so this is the obvious choice.

Assuming that you have loaded the program in Listing 2 into your machine let's start from the top. Lines 40 to 60 scatter the asterisks across the screen by adding a random offset to the address of the top left-hand corner within the range of addresses that the screen can display. This is followed by a loop, lines 70 to 90, which looks at each memory location in turn and tests to see if the contents have the same code as an asterisk, 107 in the case of our Sharp. If they do the program POKEs a white blob, code 71, into the address and moves onto the next memory location.

So far we've seen how to place a character or symbol anywhere within the screen address area and how to inspect the contents of any address. Now, if you combine these two you should be able to create any pattern or picture on the screen that you want, given the constraints that your pattern will be limited by the choice of characters available. To inspect the character set that you have available try the program given in Listing 3. This will POKE the entire character set, symbol by symbol, to the centre of the screen.

MOVING IT ABOUT

Stationary pictures and displays are all very well but most games rely on movement. Well, just as they used to say that illusionists 'did it all with mirrors' so we can create movement by 'doing it all with numbers'. The whole illusion of movement on a memory mapped screen is created by simply re-positioning the chracter you wish to move and then removing it from the position that it used to occupy. If we do this fast enough, and for the demonstration that follows BASIC *is* fast enough, the movement will appear smooth and realistic.

The program given in Listing 4 is the classic 'bouncing ball' simulation and is really very boring! However, it does serve to illustrate that simply by changing the value of a single variable, DR in this instance, we can change the direction that our ball travels in. Now, we should be able to work out a relationship between any point on the screen and its near neighbours. If we call the current position of the character we wish to move P then Fig. 1 shows the calculation you will have to make to move it into any of its surrounding positions.

The conventional way of inputting movement information to a program is to assign a set of keys to represent points of the compass. Now, as many micros possess a numeric keypad this is the ideal set of keys to use because the layout can be easily visualised as a compass, see Fig. 2. Detecting the key and acting on its command is simply a matter of writing a look-up table in which the value of the key pressed causes the program to make the appropriate modification to the character's address. A simple program to illustrate this is given in Listing 5 and should provide the necessary stimulation for you to have a go at more complex movement routines. For those interested in the really clever methods of sorting out movements by mathematical formulae the April '82 issue of *Computing Today* contains possibly the ultimate

Machine	Screen address
Apple II	1024 to 2047 (1)
Commodore PET	32768 to 33767
Commodore VIC	7680 to 8185
Compukit UK101	53248 to 54271 (2)
Exidy Sorcerer	−3968 to −2058
NASCOM 1/2	2048 to 3071 (3)
Superboard II	53379 to 54171 (2)
RML 380Z	61440 to 62209
Sharp MZ-80A	53248 to 55295
Sharp MZ-80K	53248 to 54247
TRS-80 Model I	15360 to 16383
TRS-80 Model III	15360 to 16383
Tangerine Micron	512 to 1023
Video Genie	15360 to 16383

Note (1) The screen address range varies according to the mode being used. Figures given are for Text/Low-Res mode, Page 1.
Note (2) The screen memory map is non contiguous.
Note (3) The top line of the screen is actually the bottom line in terms of its addresses.

Table 1. Some common micros and their screen memory maps. For more details consult your manual or the series Graphic Details published in *Computing Today* and the Autumn '82 issue of *Personal Software*.

Variable	Function
SP	Decimal address of top left-hand corner of the screen.
LL	Number of characters that can be displayed on one line.
PL	Number of lines that can be written on the screen.

Table 2. These variables should have the specific values relevant to your own system assigned to them; for example the TRS-80 would have SP=15360, LL=32, PL=16.

movement routine in The Valley article.

If you don't have a numeric keypad on your system it doesn't matter, any keys will do. Just select the key you wish to represent, say, North and substitute it in place of '8' in the look-up table.

WHAT TO DO NOW

Well, at this stage you should be able to look at any program that uses PEEKs and POKEs to create moving graphics and understand basically what is happening. It is always worth taking the trouble to make up a grid for your particular screen, especially if it is one of the awkward ones with wasted bytes down the edges, and to map out your displays on paper first. This will give you the addresses of any special positions that you wish to place characters in and also provide a very valuable piece of documentation for future reference.

Next month I'll be taking a look at the way you can use the PEEK and POKE commands to load machine code programs into your computer, another of those little mysteries which — until you learn the secret — appears totally baffling.

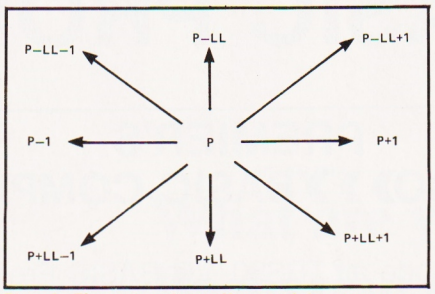

Fig. 1. The new location address can be calculated quite simply.

```
 10 SP=53248:REM ** TOP LEFT OF SCREEN
 20 LL=40:REM ** CHARACTERS PER LINE
 30 PL=25:REM ** LINES PER SCREEN
 39 REM ** DRAW LINE FROM TOP LEFT TO TOP RIGHT
 40 FOR I=SP TO SP+LL-1
 50 POKE I,107
 60 NEXT I
 69 REM ** DRAW LINES FROM TOP LEFT TO BOTTOM LEFT
    AND TOP RIGHT TO BOTTOM RIGHT
 70 FOR I=SP TO SP+(LL*PL-1) STEP LL
 80 POKE I,107:POKE I+(LL-1),107
 90 NEXT I
 99 REM ** DRAW LINE FROM BOTTOM
    LEFT TO BOTTOM RIGHT
100 FOR I=SP+(LL*(PL-1)) TO SP+(LL*PL)
110 POKE I,107
120 NEXT I
```

Listing 1. The program to draw a box around your screen. Code 107 on the Sharp MZ-80A produces an asterisk.

```
10 SP=53248:REM ** TOP LEFT OF SCREEN
20 LL=40:REM ** CHARACTERS PER LINE
30 PL=25:REM ** LINES PER SCREEN
39 REM ** COMPUTE AND POKE TO RANDOM POSITION
   BETWEEN TOP LEFT AND BOTTOM RIGHT
40 FOR I=1 TO 50
50 POKE SP+INT(1000*RND(1)+1),107
60 NEXT I
69 REM ** EXAMINE SCREEN FROM TOP LEFT TO BOTTOM
   RIGHT CHANGING STARS TO BLOBS
70 FOR I=SP TO SP+(LL*PL)
80 IF PEEK(I)=107 THEN POKE I,71
90 NEXT I
```

Listing 2. This program places 50 random asterisks on the screen and then searches for them. When it locates them it changes them to a white blob, code 71.

```
10 SP=53248:REM ** TOP LEFT OF SCREEN
20 LL=40:REM ** CHARACTERS PER LINE
30 PL=25:REM ** LINES PER SCREEN
39 REM ** DISPLAY CHARACTER SET, SYMBOL BY SYMBOL,
   AT THE CENTRE OF THE SCREEN
40 FOR I=1 TO 255
50 POKE SP+((LL*PL)/2),I
59 REM ** SHORT DELAY
60 FOR D=1 TO 250
70 NEXT D
80 NEXT I
```

Listing 3. The entire chracter set of your machine will appear, symbol by symbol, in the middle of your screen if you run this program. The delay between each symbol appearing is controlled by line 60.

```
10 SP=53248:REM ** TOP LEFT OF SCREEN
20 LL=40:REM ** CHARACTERS PER LINE
30 PL=25:REM ** LINES PER SCREEN
39 REM ** DRAW BOX
40 FOR I=SP TO SP+LL-1
50 POKE I,107
60 NEXT I
70 FOR I=SP TO SP+(LL*PL-1) STEP LL
80 POKE I,107:POKE I+(LL-1),107
90 NEXT I
100 FOR I=SP+(LL*(PL-1)) TO SP+(LL*PL)
110 POKE I,107
120 NEXT I
130 DR=1:REM ** DIRECTION POINTER
140 OP=SP+((LL*PL)/2):REM ** OLD POSITION
150 POKE OP,71:REM ** PLACE FIRST BLOB
159 REM ** HIT THE WALL?
160 IF PEEK(OP+DR)=107 THEN DR=-DR
170 NP=OP+DR:REM ** NEW POSITION
180 POKE NP,71:REM ** PUT BLOB IN NEW POSITION
190 POKE OP,0:REM ** ERASE BLOB FROM OLD POSITION
200 OP=NP:REM ** UPDATE CURRENT POSITION
210 GOTO 160
```

Listing 4. The ultimate boring program, a 'bouncing ball'. However, if you understand this principle you should be able to make anything move in any direction.

```
10 SP=53248:REM ** TOP LEFT OF SCREEN
20 LL=40:REM ** CHARACTERS PER LINE
30 PL=25:REM ** LINES PER SCREEN
39 REM ** DRAW BOX
40 FOR I=SP TO SP+LL-1
50 POKE I,107
60 NEXT I
70 FOR I=SP TO SP+(LL*PL-1) STEP LL
80 POKE I,107:POKE I+(LL-1),107
90 NEXT I
100 FOR I=SP+(LL*(PL-1)) TO SP+(LL*PL)
110 POKE I,107
120 NEXT I
130 DR=0:REM ** DIRECTION POINTER
140 OP=SP+((LL*PL)/2):POKE OP,71
150 GET A$
160 IF A$="" THEN 150
170 IF VAL(A$)=0 THEN 150
180 A=VAL(A$)
190 ON A GOTO 200,210,220,230,240,250,260,270,280
200 DR=39:GOTO 300:REM ** SOUTH WEST
210 DR=40:GOTO 300:REM ** SOUTH
220 DR=41:GOTO 300:REM ** SOUTH EAST
230 DR=-1:GOTO 300:REM ** WEST
240 DR=0:GOTO 300:REM ** STAY PUT
250 DR=1:GOTO 300:REM ** EAST
260 DR=-41:GOTO 300:REM ** NORTH WEST
270 DR=-40:GOTO 300:REM ** NORTH
280 DR=-39:GOTO 300:REM ** NORTH EAST
290 GOTO 150:REM ** SAFETY NET
299 REM ** HIT THE WALL?
300 IF PEEK(OP+DR)=107 THEN DR=0:GOTO 150
310 NP=OP+DR:REM ** NEW POSITION
320 POKE OP,0:REM ** ERASE OLD BLOB
330 POKE NP,71:REM ** PLACE NEW BLOB
340 OP=NP
350 GOTO 150
```

Listing 5. The blob can be moved, step-by step, using the numeric keypad as a compass. If you don't have a numeric keypad the ordinary numbers will work just as well or you can re-define the look-up table.

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Key features of the Sinclair ZX Spectrum

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This interface, available later this year, will enable you to connect your ZX Spectrum to a whole host of printers, terminals and other computers.

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Tel: Camberley (0276) 685311.

The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.

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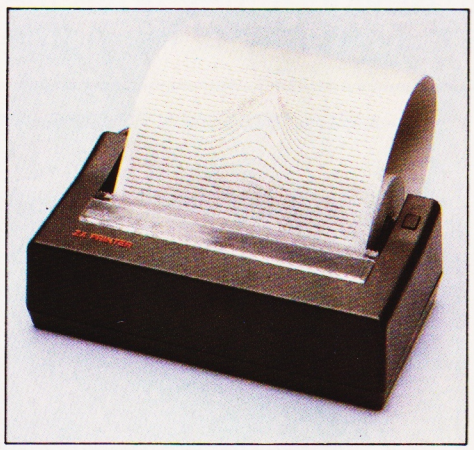
The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing.

Each Microdrive is capable of holding up to 100K bytes using a single interchangeable microfloppy.

The transfer rate is 16K bytes per second, with average access time of 3.5 seconds. And you'll be able to connect up to 8 ZX Microdrives to your ZX Spectrum.

All the BASIC commands required for the Microdrives are included on the Spectrum.

A remarkable breakthrough at a remarkable price. The Microdrives are available later this year, for around £50.



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Mike James

AN APPEALING MICRO?

Producing a successor to the Apple II proved more of a problem than many people imagined. Now that they have the Apple III established we take a look to see if it is truly worthy of the name.

The best proof that the Apple II was ahead of its time is the way that it is still selling. However, time and technology move on and Apple Inc cannot expect to survive on past glories. The obvious successor to a machine called 'Apple II' must logically be a machine called 'Apple III', and I can imagine the amount of mental effort and worry which went into the design of the machine destined to carry the name. Apart from being of interest to existing Apple II owners, the Apple III is being advertised as an ideal business machine in direct

competition with 'up-market' machines such as the IBM Personal Computer and the ACT Sirius 1.

While reading this review it is worth keeping in mind the fact that the original Apple was designed by two enthusiasts in a garage and the Apple III was designed by a very large company.

OVERVIEW

The Apple III continues the well-known chunky cabinet design which distinguishes all Apple products. If anything, it is more solidly built than the Apple II. A minimum configuration consists of two units — the machine itself, including keyboard and one disc drive, and a video monitor. The main unit is 18¼" by 17½" by 4¾" and weighs a hefty 26 pounds. Most of this weight is due to the use of an alloy 'subframe' which is used both to give the plastic outer case some support and to dissipate heat without having to resort to a fan. The use of the case as a heat sink certainly seems to work and as a consequence, the Apple III is one of the quietest computers of this size I know.

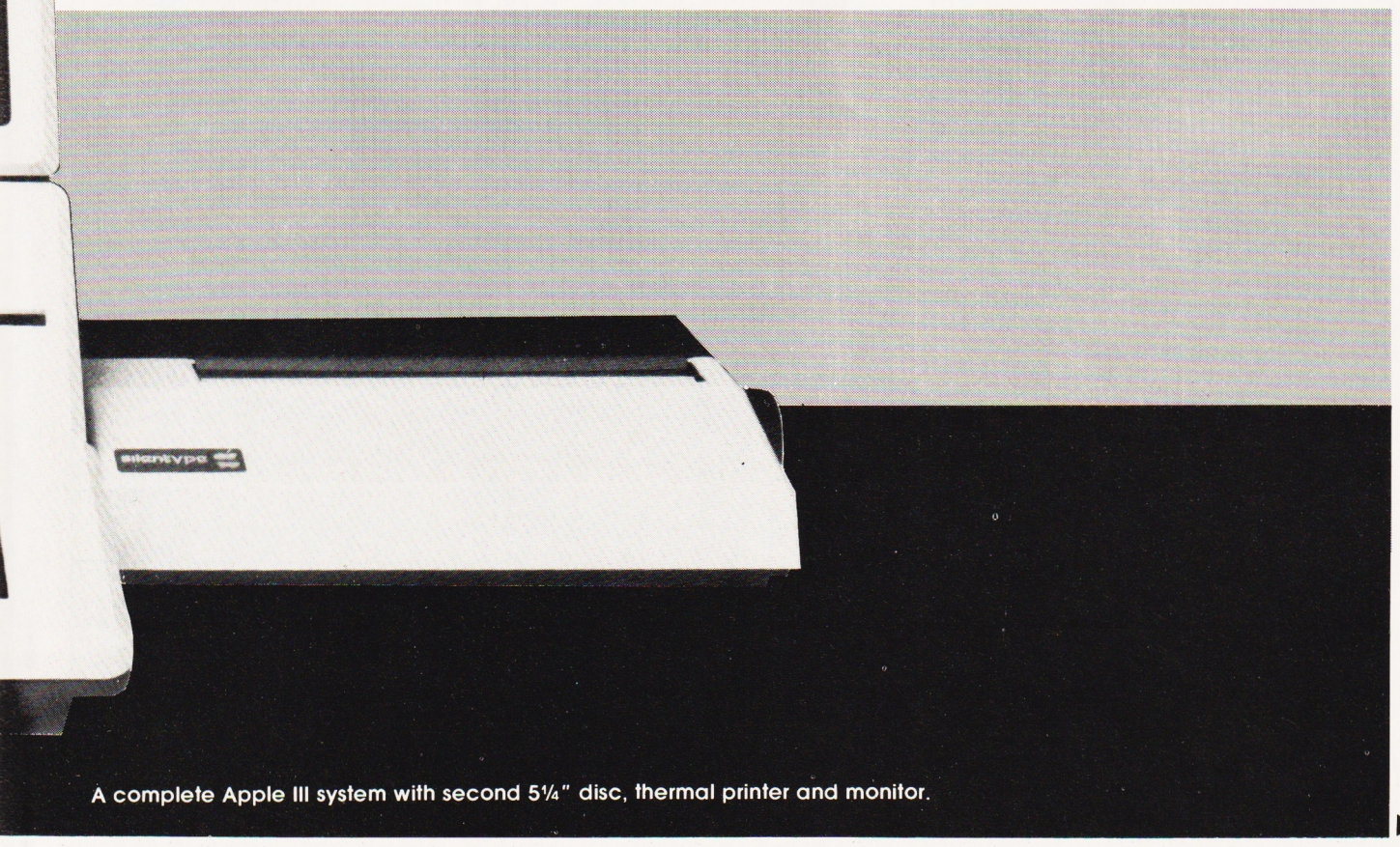
There is no question about the acceptability of the overall styling of the Apple III — it is very acceptable. However, although a machine may look good, this is not always an indication that it has been designed with a user in mind. The overall ease of use would have been improved if the keyboard had been detachable and the monitor siting had incorporated some adjustment — but I admit these things are a matter of taste.

Setting up the system is particularly easy with almost everything in one box. If you are only using a single disc drive, all you have to do is to connect a monitor. Here once again, a beautiful design is not a thoughtful design — the monitor is mains powered and as there is no switched mains connector on the back of the machine, you have to use a separate 13 A plug (and hence socket). This small problem is a shame because Apple have clearly thought it worth going to the trouble to make sure that the monitor is attractively presented in the same colour and styling as the rest of the machine. Indeed, it matches so well, you might be forgiven for thinking that it was part of a single unit but this trouble over integrating the two units doesn't extend to functional details. If you are going to use an extra disc drive, a printer or almost any other peripheral, then the extra time that it takes to connect them into the system is negligable. Unlike the Apple II, a wide range of connectors are brought out of the box at the rear. So, there is no poking around in the innards for the inexperienced user to worry about. Indeed, except for the warning not to connect anything while the system is on, there is nothing much for the user to worry about.

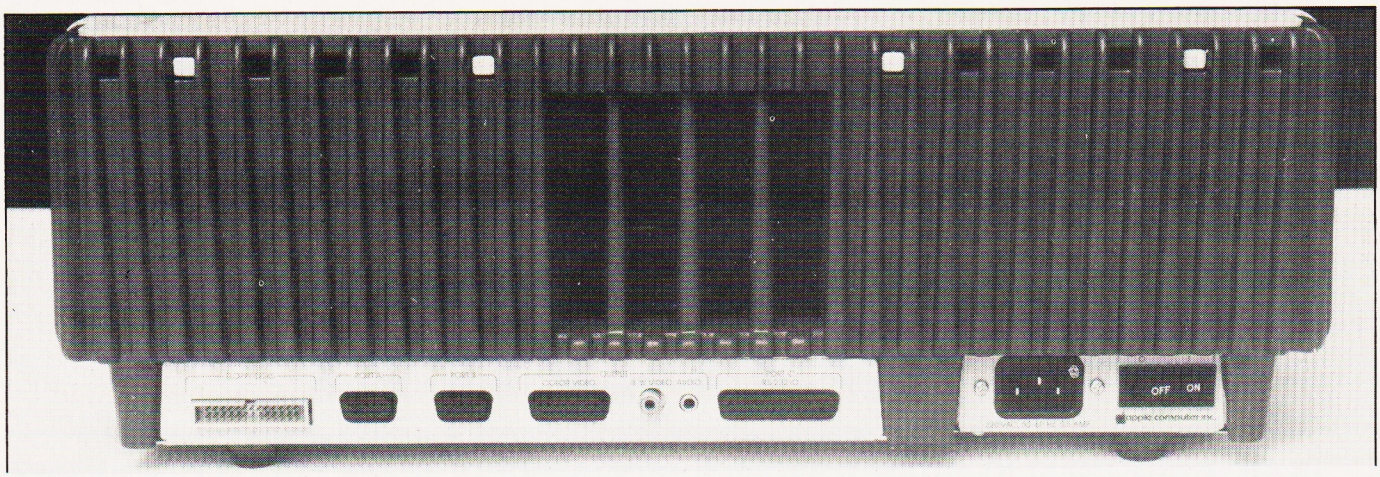
Switching the machine on not only lights a small 'on' message on the keyboard but initiates the loading of the operating system from the built-in drive. However, if you don't know that you are supposed to insert a system disc, then the system won't tell you. There are no 'insert disc' messages of the sort that you'd find on machines such as the SuperBrain, and if you switch on without a disc in place you will be treated to the extremely terse message 'RETRY'. This first exchange with the Apple III is unlikely to help a beginner. I admit that the old maxim of 'if all else fails read the manual' applies here but surely there was enough space in the sytem ROM for slightly longer messages.

OF KEYS AND CHARACTERS

Once you have whatever piece of software you want to run loaded and working, the machine is quite good-natured and reasonably pleasant to use. However, once again, there are enough small annoying things to spoil the overall effect. The keyboard has already been mentioned in connection with its fixed position on the main case. It is a very high quality unit and contains all the keys that were missing on the Apple II and so frustrated a whole generation of personal computer owners. Even so, the layout could be



A complete Apple III system with second 5¼" disc, thermal printer and monitor.



If the standard I/O isn't enough you can add your own interface cards internally. The vertical slots provide both cooling and cable access.

improved on; the cursor keys are mounted in an 'L' shaped pattern in the right-hand corner, for example.

On the positive side, the entire keyboard is under software control and can be re-programmed to produce any layout or function. Two new keys and symbols — Open Apple and Closed Apple — are provided for special control functions. Auto repeat is featured on every key at 11 cps unless the Closed Apple key is also pressed when the repeat rate is 33 cps. There is also a numeric keypad mounted at the right-hand side of the main keyboard area.

It is also a relief to discover that the full 128 ASCII character codes can be generated without any modifications. The Apple II 'featured' a Reset key on its keyboard which must have lost many a user many a program. This problem has been overcome in the Apple III (and in later versions of the Apple II) by making the Reset function only if the Control key is pressed at the same time. One pleasant advanced feature is the presence of a 128 character 'type ahead' buter. This means that there is no need to wait for an operation to be completed before you type the next command or even a list of them. The only trouble is that what you have typed is only echoed on the screen when the Apple III has *finished* what it was doing!

The monitor supplied with the Apple III is unsurprisingly called 'Monitor III'. It is a 12" green screen monitor with an anti-glare filter as standard. As already mentioned, it is styled to fit in with the rest of the system and is well up to the task of displaying the high resolution graphics and the range of tones which the Apple III can produce. However, it has such a long persistence phosphor that a clear screen command makes the display fade as if someone was turning the brightness down slowly. This is no problem for graphics and paged text, but as soon as anything scrolls up the screen — reach for the sea sick pills!

MODUS DISPLAYUS!

There are three distinct text display modes and four graphics modes. The presence of a standard 24 line by 80 column text screen is something that will come as a great relief to Apple II users. However, if you are emotionally attached to the Apple II's screen, there is a 40 column mode to keep you happy. The full range of text modes are given in Table 1 and indicates the potential for a Teletext/Viewdata compatible display.

Mode	Format	Colours
0	24x40	black and white
1	24x40	16 foreground 16 background
2	24x80	black and white

Table 1. Text modes.

It is worth mentioning that the character sets are all user-definable and a number of interesting alternative character sets are provided on disc. The characters are created by a seven by eight dot matrix which is slightly smaller than used on most machines with user-definable characters.

The Apple III graphics modes are a considerable improvement over the Apple II, but not any better than the sort of thing offered by machines in a lower price bracket such as the BBC Micro. The highest resolution available is 560 by 192 in black and white only which should be compared to the BBC's 640 by 256 in two colours. The largest number of colours is 16 in a 140 by 192 resolution display which should be compared to the BBC's 16 colour 160 by 256 display. However, the Apple III has a true 16 colour palette whereas the BBC Micro makes 16 colours by counting eight colours and the same eight flashing as 16.

Colour value	Colour	Grey level
0	black	black
1	magenta	
2	dark blue	
3	lavender	
4	dark green	dark grey
5	grey	
6	medium blue	
7	light blue	
8	brown	medium grey
9	orange	
10	grey 2	
11	pink	
12	green	light grey
13	yellow	
14	aqua	
15	white	white

Table 2. Apple III's colours and corresponding grey scale.

If you don't use a colour monitor (I have a feeling that most users of the Apple III won't) the 16 colours are displayed as 16 shades of grey. The full range of graphics modes can be seen in Table 3.

Main screen	Second screen	Resolution	Colours	Memory
0	4	280x192	b/w	8K
1	5	280x192	16 with limitations	16K
2	6	560x192	b/w	16K
3	7	140x192	16	16K

Table 3. The graphics modes and their cost in memory.

One innovation worth mentioning is the presence of two screen buffers for each graphics mode. This means that it is possible to write to one screen while displaying another. Another improvement over the Apple II is the ability to freely mix text and graphics. Mode 1 can be used to display 16 colours at fairly high resolution, but only two colours can be displayed in any one seven dot row that would be used to display a character. (This is similar to the INK and PAPER method used by the ZX Spectrum to increase the number colours for a given amount of RAM.) In graphics mode 3 it is possible to create some remarkable graphics displays. The most interesting technique is the mixing of colour dots to produce an almost limitless range of intermediate colours.

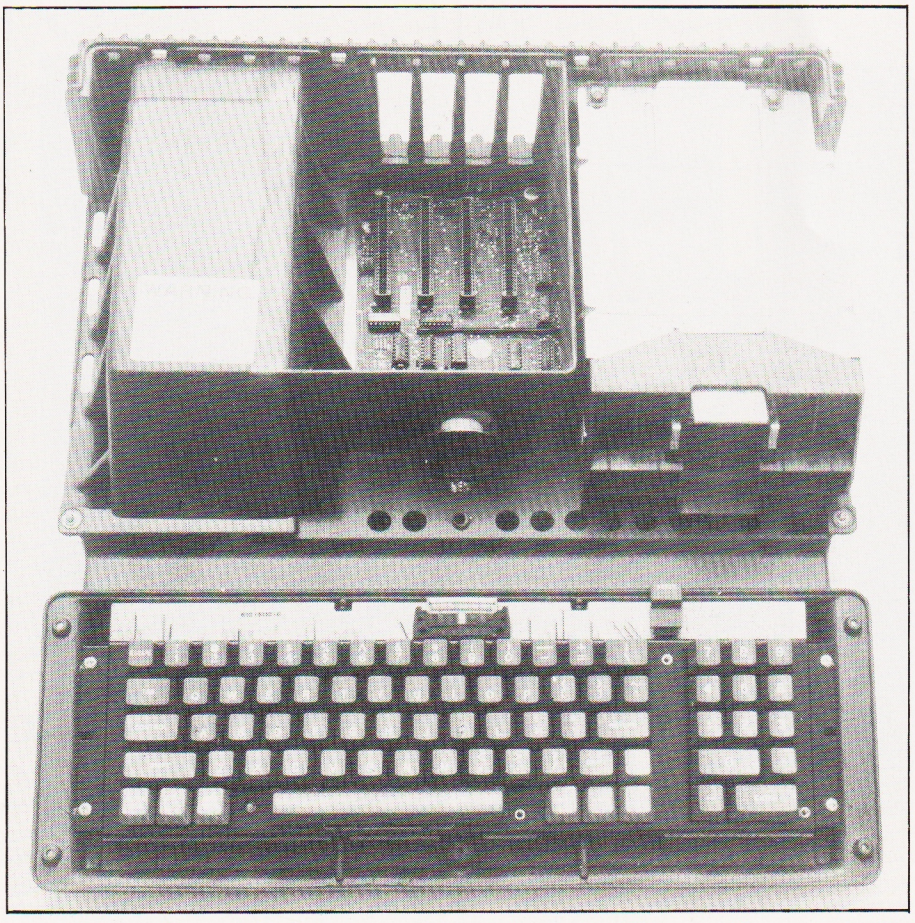
The single built-in 5¼" disc drive is the main storage device used on the Apple III and it is the fact that it is single which is the source of most of my criticism. Most other systems of a comparable price (or cheaper) manage to offer twin disc drives as standard — why not the Apple III? It is true that the software always takes account of the fact that there may only be a single disc drive in the system. For example, the copy routine will prompt you to change discs during a single drive copy, but this sort of thing is slow and for the inexperienced (or accident prone) dangerous! The total amount of storage on a single disc is a very reasonable 143K (single-sided double-density).

HARDWARE

The Apple III is based around a 'traditional' 6502B running at 2 MHz, but with Apple-designed circuitry to allow extended addressing. This means that, without any risk of software incompatibility, the standard machine can be supplied with 128K of memory. This can be expanded by adding chips on the main circuit board up to a total of 256K. The theoretical upper limit on the amount of memory which the extended addressing can handle is 512K. This all sounds very reasonable when compared to machines such as the ACT Sirius I which also sports a very acceptable 128K of RAM. However, it must be clearly understood that the Apple III achieved this memory range via a sophisticated application of traditional bank switching techniques. In the Apple III, up to fifteen 32K memory banks can be switched in and out of the normal memory range between 2000 and 9FFF Hex. Thus, although it has 128K, it only has a standard 64K of memory at any one time.

This said it also has to be pointed out that the bank switching is carried out automatically by the operating system and is as user-transparent as bank switching can be. It is difficult to work out from what little information Apple have provided, how easily any software can take advantage of the full memory, but the single disc copying program is certainly not reading anything like even 1/10 of a disc at a time so its buffer must be fairly small.

Inside the Apple III's box, things are neat and well designed. All the electronics are inside a thin metal case for RF screening purposes. The only section of the hardware that is of any interest to a 'normal' user is the peripheral expansion area. Four Apple II-style PCB sockets are provided for a range of peripheral interface cards. From the hardware point of view, these are essentially the same as the slots on the Apple II — although there is no guarantee that Apple II cards will work on the Apple III and even if they do, it is still necessary to write new software drivers to integrate them into the operating system. Four slots may sound like far too few to anyone used to an Apple II full to the brim with extra cards, but remember all those extra cards were needed because the Apple II has so many missing features which are standard on the Apple III.



Internal layout is neat, the interface slots can be seen at the rear. The sealed unit on the left is the power supply.

BIG BOARDS

Nearly all of the electronics is contained on one very large PCB. The only exception is the presence of sixteen 64Kbit dyanamic RAM chips on a board fitted over the main PCB. The main PC board is very full and contains a bewildering variety of TTL chips — disc controller, serial interface, video circuitry, bank switching and so on. The whole thing is built to the standard which made the Apple II so reliable.

The only interesting feature of the 6502 is that it is a double speed device. However, it is important to notice that it only runs at 2MHz during the video blanking period and 1MHz at all other times. This gives an average execution rate of around 1.5MHz which is not quite as fast as you would otherwise expect.

The Apple III disc system uses the well tried Apple II method of having the discs under full stotware control and they are incompatible with the rest of the disc-using world. One of the most annoying results of this form of disc control is the way the head always does 255 stepouts to ▶

reach track 0 during a disc reset. This results in the familiar rapid clicking which comes from an Apple disc drive as the head rams itself against the end stop! I find it difficult to understand why this crude method of positioning is necessary — other manufacturers discovered the track zero indicator long ago! The main reason for adopting this minimum-electronics method of handling a disc drive is to reduce the manufacturing costs. It is a pity that Apple haven't found a way to pass this on to the customer.

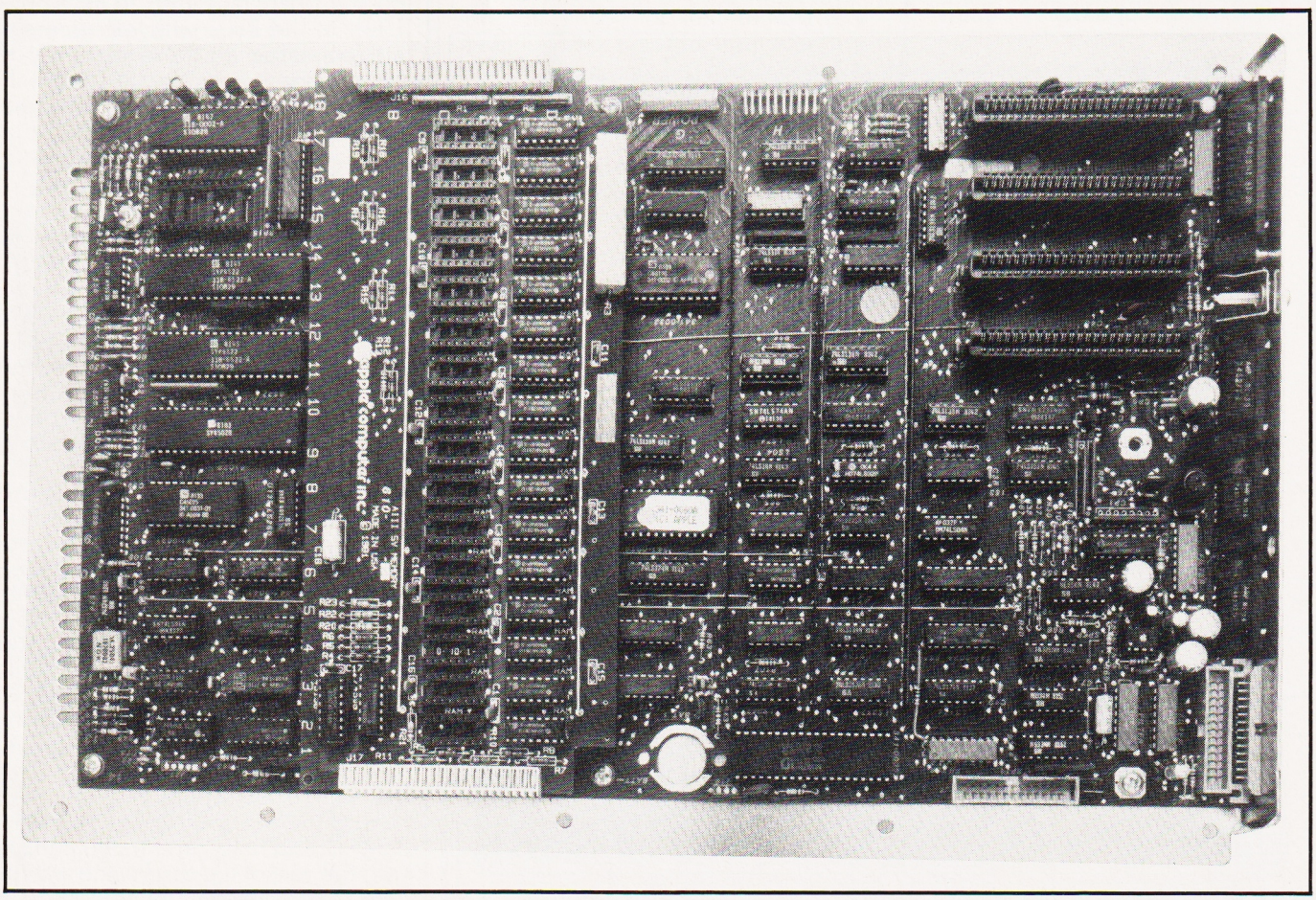
SOFTWARE

The Apple III is not only a new piece of hardware, it is a completely new operating system. Apple's new operating system is called SOS, standing for Sophisticated Operating System. Apple have always gone their own way when it comes to operating systems and SOS is no exception. Heavily influenced by the UCSD Pascal operating system, SOS does at least try to break new ground. However, from a user's point of view, SOS is just as difficult to come to terms with as CP/M.

The overall structure of SOS suggests that it has been designed with an eye toward certain academic attitudes on system software, but unfortunately with only half an eye toward the user. There is no direct user interface with SOS — any disc operations are either done via the current high level language (ie rather like DOS 3.3 from BASIC) or from a utility program which presents a menu of options. The operating system commands within the high level languages are no better and no worse than those of any other operating system — you read the manual and follow the rules. However, the menu driven utility program provides a way for the inexperienced user to come to terms with simple operating system functions such as copying discs. The trouble is that although the menu program tries to be as helpful as possible, it fails on points of detail. For example, the main menu offers the option of re-configuring the operating system — something that you are unlikely to do often — and file management — something that you are likely to do very often.

If you happen to make a mistake while entering your selection, the program also has the unfortunate habit of printing an error message which covers part of the menu — so if you make mistakes you'd better have a good memory. The error messages given by most of SOS are reasonable English but the formatting program tends to relapse into error code gibberish. Finally, the utility program is so large that it isn't possible to fit it onto a disc with anything else on it, so in a single drive system there can be a lot of disc swapping. All in all SOS is an interesting operating system but it could do with some of the rough edges cleaning up.

Something that might come as a surprise to anyone used to CP/M or the earlier Apple DOS will be the use of hierachical directories. A single disc can have an number of directories and each directory may also contain the names of other directories. To access any particular file, it is necessary to give its complete name in terms of which directory it is in. For example, the file BOOKS/COMPUTER/MICROS/REPORT might be a file called REPORT (containing a report on microcomputer books) in the directory MICROS which is in the directory COMPUTER which in turn is in the directory BOOKS. Fortunately, there are ways of avoiding having to type all the names that go to identify a file; this is done by specifying a default directory. Unless you have used this sort of hierachical filing system, it is difficult to appreciate how useful it



A quick peek at the main PCB reveals that we've only got half the maximum memory installed, 128K! Overall construction is excellent.

can be. If you have a number of users trying to share a large capacity hard disc, for instance, it is possible for each user to have their own directory system exactly suited to their needs. However, if you are a single user with a small capacity removable disc drive then a simple directory structure (such as used by CP/M!) is preferable.

Apart from SOS, the other major pieces of software on the Apple III are Business BASIC and UCSD Pascal. The main shock about the BASIC is that it's not Microsoft BASIC! Apple's Business BASIC is like Microsoft V5, but it has quite a few extra features. It is more than adequate and it should provide the foundation for a wide range of software. The only trouble is that the extra speed provided by the 6502B is almost totally lost by the complexity of the BASIC. However, it must still be regarded as fast — see Table 4 for the results of the Benchmark tests.

Test	Time taken
Test 1	1.9
Test 2	7.3
Test 3	13.6
Test 4	14.5
Test 5	16.0
Test 6	27.2
Test 7	42.5
Test 8	7.6

Table 4. Results of Benchmark tests.

The Pascal is the well-known UCSD Pascal V2.1 and as such, cannot be critisised. It is fast and a fairly complete implementation of Pascal. Anyone used to Pascal on the Apple II should have no trouble using the Apple III in Pascal.

While on the subject of Apple II users, it is worth mentioning that there is an Apple II emulation program. On booting with the Apple II emulation disc, the user is given a menu of options which can be used to define the Apple II system to be emulated — the default is a 48K machine running DOS 3.3 (16 sector disc), Applesoft BASIC and one serial port. You can select Integer BASIC and generally produce a system which will run most Apple II programs.

EXPANSION

There are a number of expansion options available to the Apple III owner. The memory can be expanded from the standard 128K without the use of extra PCBs. A second disc drive can be added with ease but only as a separate unit outside the case. A 5M hard disc is available for anyone wanting very large storage capacity. Adding a printer is also no problem. However, when it comes to the vast range of Apple II add-ons, the Apple III has to be treated with caution. Unless a manufacturer specifically states that an Apple II board can be used with the Apple III stay clear of it — at the very least you will have to write a SOS device driver for it.

In the way of software, there is already a good selection of well-known applications packages — Visicalc, a reworked Apple Writer, etc. On the high level language side COBOL and FORTH are promised soon.

DOCUMENTATION

As always, Apple's documentation is superb. The manuals are nicely presented and very thorough. They lead a beginner through the details of getting started with the minimum of pain. There is an important difference between Apple's approach to documenting the Apple III and documenting the Apple II. Apple II users will recall the detailed technical information which came with every machine — even a circuit diagram. In my opinion, this helped to make the Apple II a more versatile machine. People could use the Apple II for a wide and imaginative range of applications — to a certain extent this explains why the Apple II is one of the favourite machines for science, education and technology. Now it appears that as the Apple III is aimed at a slightly different group of people, technical information is something to be hidden in case it frightens someone! The point is that having a group of knowledgable and enthusiastic experts is one of the best ways of making sure that a machine is popular, and by not providing any real technical information with the Apple III, Apple are making it less likely that existing Apple II users will want to get acquainted with the Apple III. This said, I have to add that Apple's general approach to customer service is and always has been excellent!

CONCLUSION

The Apple III is a diverse machine both in hardware and software features and it is difficult to do it justice in a single review. No matter how good or bad it is, it is likely to do well because it is produced by Apple. However, Apple have moved a long way from two enthusiasts working in a garage to produce the Apple I. Much of the innovation of those days seems to have gone and the Apple III is the product of a large company with a single very successful product. In my opinion, the Apple III is not really a fitting successor to the Apple II in that it isn't as far in front of the field as the Apple II was when it was first announced — but then when you only have a garage to support, you can afford to take risks!

FACTSHEET Apple III

CPU	6502B	
Clock	2 MHz (effectively reduced to 1.5 MHz)	
ROM	4K	
RAM	128K bank switched	
Language	BASIC, Pascal	
Keyboard	QWERTY 74 keys Numeric keypad Cursor control keys	
Display	Three text modes (with software-definable 128 character sets) 24 by 80, black and white 24 by 40, black and white 24 by 40, 16 colour Four graphics modes 520 by 192, black and white 280 by 192, black and white 280 by 192, 16 colours (with limitations) 140 by 192, 16 colours (no limitations)	
Cassette I/O	None	
Options	RS232, games paddles	£384.00
	5¼" discs	£476.00
	Extra memory	£2256.00
	Profile 5M6 Winchester disc	
Costs	Apple III (with 128K, Monitor III and SOS)	£2418.00
Supplier	Apple Computer (UK) Ltd, Eastman Way, Hemel Hempstead, Herts HP2 7HQ 0442-60244	

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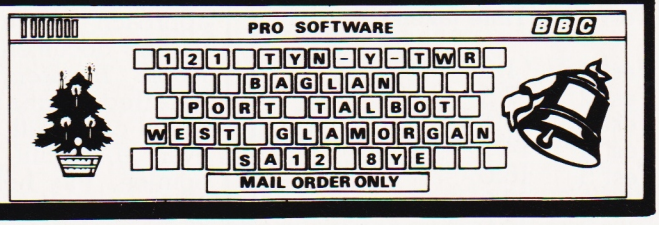

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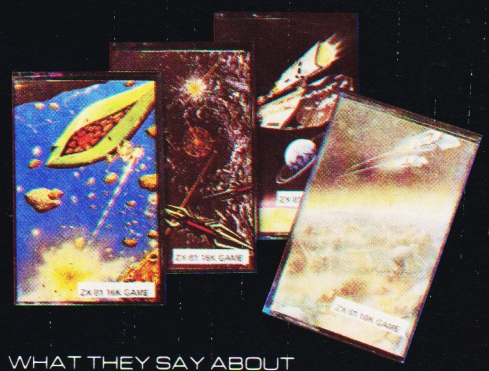

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COMPETITION RESULTS

Were you one of the incredible number of entrants for our ZX Spectrum competition? If you were then now is the time to find out whether you won one of the prizes that we had on offer. The level of entries was unprecedented, obviously a lot of you wanted to get your hands on one of the machines very badly indeed, but, sadly, there can only be three winners.

The Wordsquare puzzle produced a wide range of answers but there is only one proper solution and that is given below. We did warn you that the words you were looking for had directconnection with the Sinclair organisation but many seemed to ignore this!

THE WINNERS

First out of the Editor's ten-gallon hat and winner of the complete system was John A Bell of Derby. Following closely on his heels was Richard Allen of Tamworth who picks up the ZX Printer and the winner of the £25s worth of ZX Software was Russell Johnson of Wembley.

Our congratulations to these three lucky gentlemen, your prizes should already be winging their way toward you direct from Sinclair Research.

```
                    e                   M I C R O D R I V E
                  v   y                 C A M B E R L E Y
          r i       i   e               F E R R A N T I
          e t e     r s l               B R A D B E E R
          e n r     d r r     e t       R E S T O R E
          b a o     o e e     l h       V I C K E R S
          d r t     r k b     r g       B R I G H T
    a     a r s     c c m     a i       C I R C L E
    l     r e e     i i a     e r       R A M T O P
  p u   t B f R     M v C     s b       S E A R L E
  a     i i a       e i                 P A P E R
  p   n   m m       R                   T I M E X
  e     t     e c   g                   M E R G E
  r   o       l x   e                   B I N
    p       e                           U L A
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Shared letters:

B = 2
C = 3
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R = 18
R = 18

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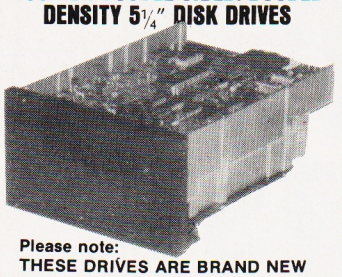

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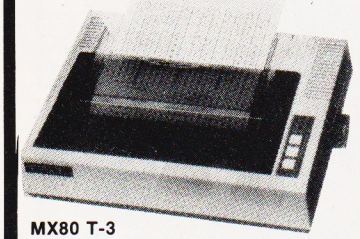

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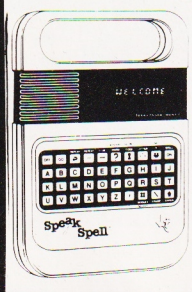

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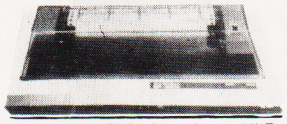

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1. Please rate the following articles on a scale of 1 to 9. If you didn't read the feature please score it 0.

FEATURE	SCORE	FEATURE	SCORE
Consumer News		Reader Survey	
Business News		Printout	
Pascal Profile		Soft Wares	
An Appealing Micro			
Cheap Print			
Kepler's Revenge			
VIC Blow-Up			
PEEK & POKE Explained			
# File			
Viewpoint			
Book Page			
Elegant Programming			

2. We cover a wide range of topics in the magazine. If you think we should pay more or less attention to any of the following, or if you think we've got the balance right, please indicate below.

	More Wanted	Less Wanted	Alright Now
Educational features	☐	☐	☐
Programming features	☐	☐	☐
Hardware features	☐	☐	☐
Games software	☐	☐	☐
Applications software	☐	☐	☐
Equipment reviews	☐	☐	☐
Software reviews	☐	☐	☐
Book reviews	☐	☐	☐
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5. How long do you keep copies of the magazine?

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8. How many *other* people read your copy? .....

COMPUTERS AND YOU

9. Do you use a computer in your job?

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If Yes do you make purchasing decisions on computer equipment?

Yes ☐ No ☐

10. Do you have your own computer at home?

Yes ☐ No ☐

If you have your own computer please indicate what type it is.

11. If you own a computer, or are planning to purchase one, how much do you intend to spend on it over the next year?
.....

12. How much did you spend on your computer system over the last year? .....

13. Are you planning to purchase any of the following peripherals? Please indicate which, and your approx budget for each.

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Discs	☐	☐
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Systems software ☐
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18. To which of the following standards were you in full-time education?

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HNC ☐ TEC ☐ Degree ☐

19. If you are still in full-time education which of the above levels are you currently at? .....

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21. Occupation:.....

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Yes ☐ No ☐

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MicroDecision	
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Microcomputer Printout	
Electronics & Computing	
Computer & Video Games	
Personal Computing Today	
Sinclair User	
ZX Computing	
Which Micro & Software Review	

29. Do you read any of the weekly or trade publications?

Yes ☐ No ☐

Please indicate which

Computer Weekly ☐ Computing ☐ Datalink ☐
MicroScope ☐ Computer Talk ☐ Other ☐

30. Do you read any of the American publications?

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31. Do you read a daily newspaper?

Yes ☐ No ☐

If Yes, which one? .....

32. Do you read a Sunday newspaper?

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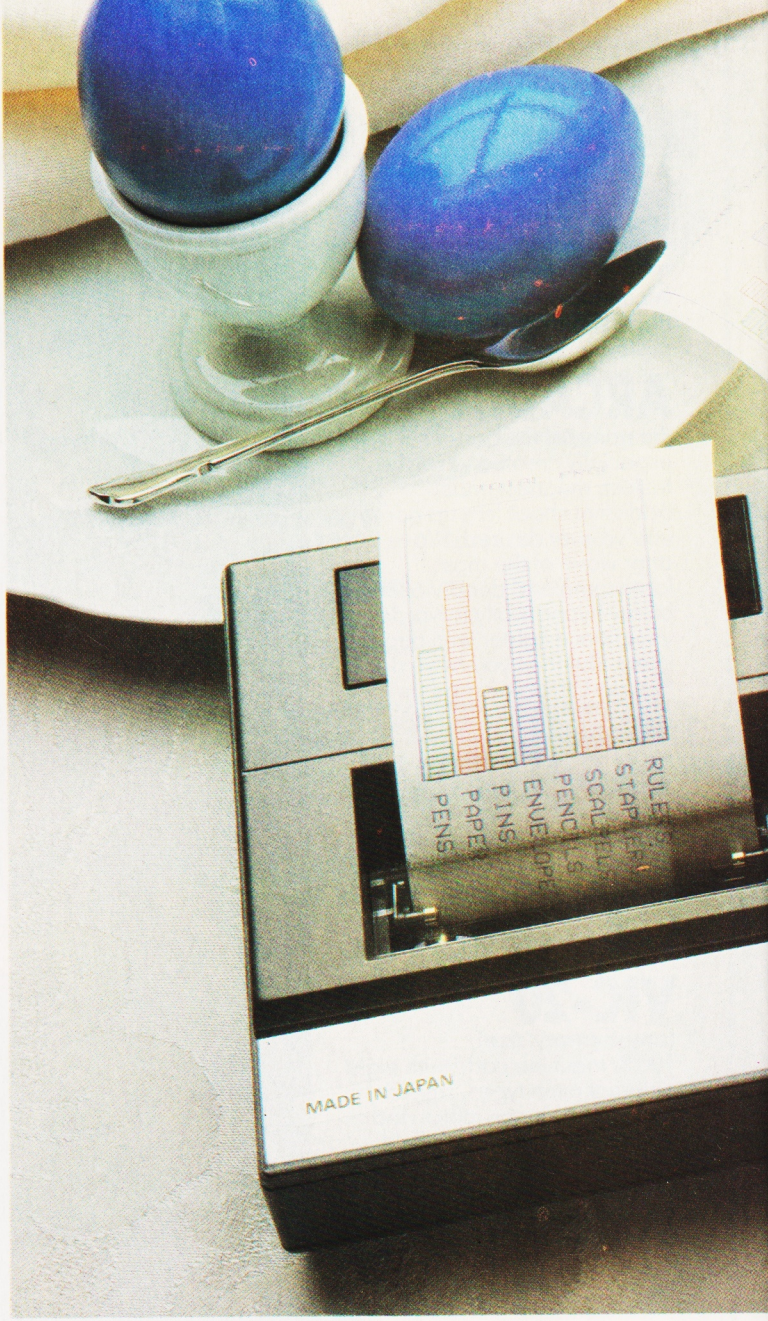

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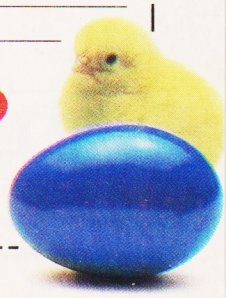

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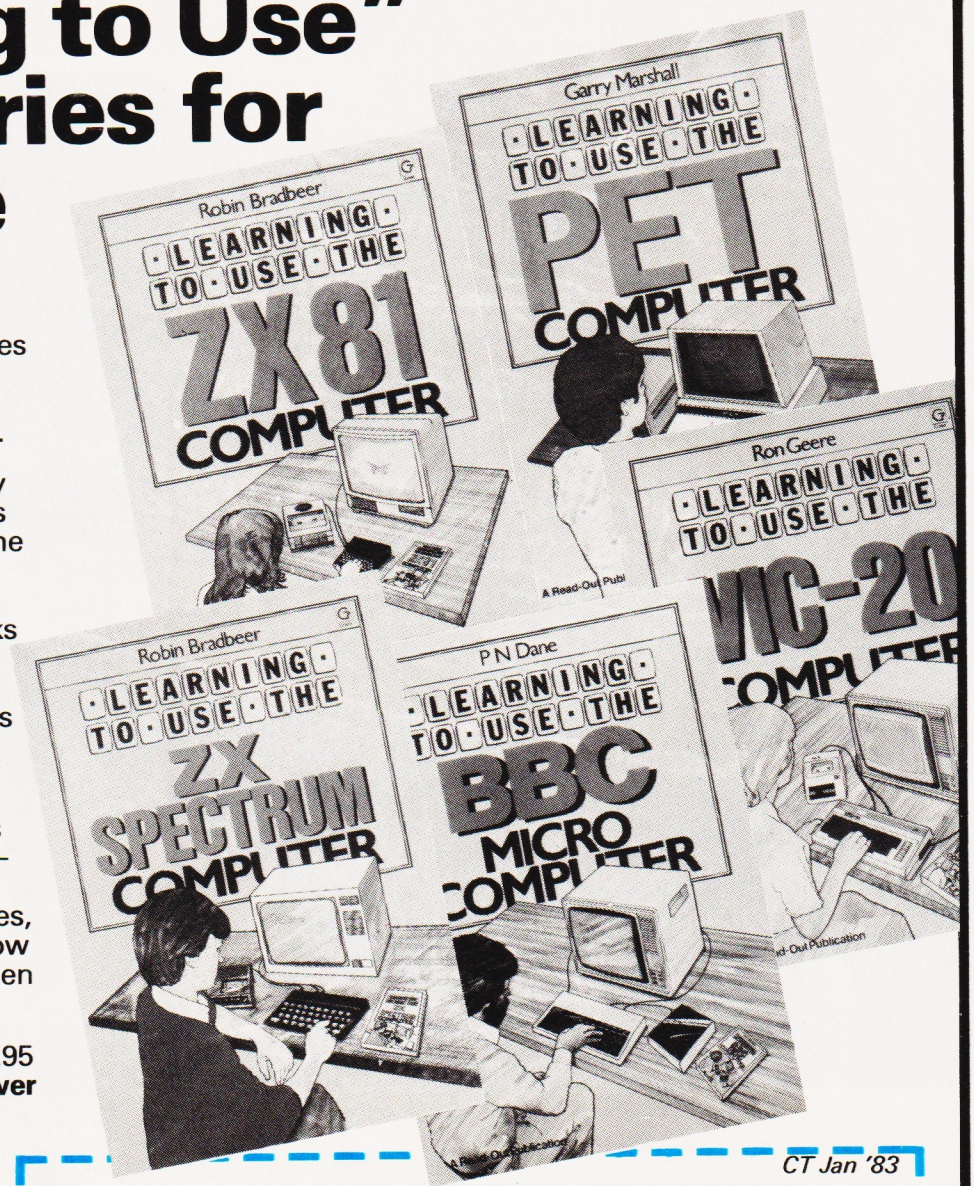

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Mike James

ELEGANT PROGRAMMING

Following on from last month's discussion on data types we take a look at the methods that can be used to structure them.

Last month we looked briefly at some of the fundamental data types that can be used to construct programs. Even if we added all the obscure data types to this list we would still lack such familiar things as arrays and strings. To produce the wide variety of data 'objects' that are essential to programming we have to discover ways of organising the fundamental types into 'data structures'. In other words we need to define ways of 'structuring data'. The best way of understanding this idea is by looking afresh at a well known example.

THE ARRAY

Because of the way that programming languages are taught it is quite common for programmers to miss the idea of constructing new data items by applying a structuring method to existing data types. For example, the idea of a one-dimension BASIC array is often introduced as a completely new idea. It is described in terms of the rules for using it and what it can be used for. However, a one-dimensional array is nothing more than a 'collection' of real variables with a special way of naming each variable. The traditional way of thinking of this collection is as if the variables were lined up in a row (or column!). The whole collection is given a name — the array — and in order to refer to any of the variables that make up the array it is necessary supply a two-part name. The first part is the name of the array, there may be more than one array in a program, and the second part specifies which variable within the array you are referring to. This second part of the name is often called the 'qualifier' and the whole two-part name is 'qualified name'. This idea of a qualified name will crop up time and again when learning about structuring methods.

This rather academic description becomes a lot more familiar when related directly to the one-dimensional array that we have been considering. The array name is (in most versions of BASIC) a simple variable name — A, for example. The qualifier comes from the idea of the variables lined up in a row. Any variable can be picked out by giving its place in the line. The only problem is what to call the first variable — 0 or 1. Some versions of BASIC call the first variable 0 and others 1 but, for the sake of simplicity, we will assume that the first variable is called 1. Thus the qualifier part of the name takes the form of a number starting at 1 and ending with the number of variables in the array. A qualifier that takes the form of a number is more often called an 'index' so the usual way of writing the name of a variable in an array is:

array name (index)

For example, A(5) refers to the fifth variable in the array called A.

Once you have realised that forming an array is a structuring method it is possible to use the same method to produce a wider range of arrays than are normally present in BASIC. The first thing that can be done is to allow other types of fundamental variables to be organised into arrays. For example, you can line up integer variables to form integer arrays and character variables to form character arrays (not to be confused with strings). No matter what fundamental variable is used to form an array the basic idea is the same — to reference a single element you have to use a qualified name.

A less obvious way of extending arrays is to allow the type of the qualifier to be something other than a number.

For example, A(wed) would refer to the variable that was used to store something to do with Wednesday. In general it is possible to imagine arrays where the qualifier part of the name is any scalar (see last month's article in this series) apart from a real number. In practice BASIC ignores this extension and restricts qualifiers to integers only. This is no great disadvantage because if the method for constructing scalar types suggested in last month's Elegant Programming is used, expressions such as A(mon)=56 will work because 'mon' is a simple variable holding an integer.

The most important extension to arrays arises from the observation that a structuring method isn't restricted to ordering fundamental variables but can be used to order data types produced by an earlier application of a structuring method. For example, ▶

applying the structuring method that results in a one-dimensional array to organise a collection of one-dimensional arrays results in what is more often called a two-dimensional array. Each one of the data items that is lined up in a row is itself a one-dimensional array consisting of a line of real variables. Now, to refer to one of the real variables it is necessary to supply two qualifiers (indices). The first indicates which element of the first array if required and as this element is itself a one-dimensional array, a second qualifier is needed to indicate which real variable in this array is needed. If a two-dimensional array A consists of a line of three data types, each of which is itself an array of five real variables, then A (2) (4) is the fourth element in the second constituent array. Some versions of BASIC allow this doubly qualified name to be written as above (ZX BASIC, for example) but most demand that the indices are written within one set of brackets and separated by a comma; ie instead of A (2) (4) you must write A(2,4). This difference in notation hides the fact that:

A two-dimensional array is not something new and different, it is simply the result of applying the same structuring method twice

The traditional way of thinking about two-dimensional arrays as a table of variables with each individual identified by a particular row and column number also hides this fact. However, if you notice that the table can be thought of as a row of columns (or *vice versa*) you should be able to see the connection between one-dimensional arrays and two-dimensional arrays.

IMPLEMENTING ARRAYS

The job of actually creating an array is normally carried out by whatever BASIC interpreter or compiler you happen to be using. All you have to do is write DIM A(10) and an array of ten elements is created for you to use. However, it is sometimes useful to be able to create arrays directly. For example, if you want to use an array with 1000 elements where each element will only be used to store a number in the range 0-255 then you can save a lot of storage by implementing your own array. If you simply write DIM A(1000) then BASIC will allocate 1000 variables for you to use and each variable will be capable of holding numbers of a much greater range then you need. A real variable will often use four memory locations to store a single number — thus A(1000) typically uses around 4K of memory. However, if your version of BASIC gives you some way of reserving memory for such things as machine code routines etc then you can implement the array A(1000) directly into 1K — a quarter of the usual storage. The method is simply to use POKE to store values in the elements of the array and PEEK to recall them. The only problem is finding which variable corresponds to which memory location. If we suppose that the start of the memory area is stored in the variable START and the index of the required element is held in I then the address of the memory location is simply START+I−1. (The '−1' is necessary because the first element has an index of 1 and its address is START.) To store VALUE in A(I) we use:

```
POKE(START+I-1),VALUE
```

To recall the value in A(I) we use:

```
VALUE=PEEK(START+I-1)
```

The expression START+I−1 gives the address of the memory location used to hold the value corresponding to A(I). Because this expression relates elements of the array to a particular memory location it is referred to as a Storage Mapping Function or SMF for short.

The idea of an SMF can be extended to include cases where each element takes more than one memory location to store. If each element takes N memory locations to store and the first one is numbered 1 the SMF is:

```
START+(I-1)*N
```

which, if N=5, gives START+5 for the address of the second element in the array.

Using what we have already learned about one-and two-dimensional arrays it is easy to extend this to an SMF for a two-dimensional array. If the array is to be DIM A(X,Y) and each of its elements takes only one memory location to store then the SMF is

```
A(I,J)=START+(I-1)*J+J-1
```

If you look carefully at this SMF you should be able to see that the first part is the address of an element of a one-dimensional array where each element is J memory locations long.

STRINGS AND THINGS

As the above discussion of the way that the BASIC array can be extended (using any data type to form the elements and any scalar type to form the indices) was followed by the admission that these things cannot be done in BASIC, you might imagine that BASIC is lacking in data structures. While this is true it might come as something of a surprise to discover that the humble BASIC string is a very advanced (and necessary) data type that isn't present in some very sophisticated languages — standard Pascal, for instance. If you've followed the discussion of arrays in any detail you may be wondering what the fuss is about — surely strings are just one-dimensional arrays of characters. Well, it is true that one-dimensional character arrays are often used to perform the same job as strings but they are not strings.

The key difference is that an array of characters has a fixed length but a string can change its size.

Some versions of BASIC (ZX BASIC for instance) provide both character arrays and strings and this can be a constant source of trouble to beginners. For example, in ZX BASIC DIM A$(10) results in a character array being formed with exactly 10 elements. This means that you can write thing like A$(3)="Z" which stores Z in the third element of the array. But, if you print now out the array using PRINT A$ you will get all 10 character variables printed even if you have only ever stored one letter in the array. However, the string B$ behaves in an entirely different way. Just like the character array, it is a collection of characters but it alters its size as the number of characters stored in it changes. That is, B$="Z" doesn't just store Z in the string variable B$, it also creates the storage space necessary to hold *one* character. If you had written B$="XYZ" then enough storage would have been allocated to hold

three characters. You can, therefore, think of a string as a character array that has a variable number of elements. A data type that can change its size while a program is running in the way that a string can is known as a 'dynamic variable'. In general dynamic variables are more difficult to implement than static variable and so many programming languages ignore them.

The similarity between character arrays and strings is something that is not often brought out by BASICs. One exception is ZX BASIC where individual elements within strings and character arrays can be accessed by specifiying an index, ie B$(3) is the third character in B$ whether B$ is a string or a character array. Other versions of BASIC, Microsoft for example, don't even allow character arrays and treat strings as fundamental data types. To access the Ith element (character) in a string you have to use a function such as MID$(A$,I,1).

As before, the structuring method that produces an array can be applied to character arrays or strings to produce two-dimensional character arrays or arrays of strings. The differences between these superficially similar data structures once again stems from the variable length property of strings.

RECORDS

Now that the idea of an array has been explored in detail the idea of a data structuring method should be easy to understand. Unfortunately, the array is the only real data structuring method that BASIC possesses. However, it is worth looking around to see what other languages have to offer and BASIC lacks. In particular it is worth knowing something about the 'record', a structure related to the array. Even though BASIC does not contain any way to construct records it can make programming easier to *think* in terms of records.

Before computers records were kept on paper and contained entries such as a person's name, address and telephone number. In other words, a record is a collection of variables of different types — the name and address are string variables but the telephone number is an integer. Some languages, Pascal for instance, provide facilities to define such collections of different variables under a single name. One way of thinking about this is to imagine a record as a one-dimensional array where each element can be a different data type. For example, the name/ address/telephone number record might be defined something like:

```
RECORD  person = name : string
                 address : string
                 telenumber : integer
```

(The details of such a definition obviously depend on the language being used but the general form remains the same.) The name of the whole record is 'person' and this plays much the same role as the array name. Each element of the record is known as a field — thus 'person' is a record with three fields — 'name', 'address' and 'telenumber'. Each field has an associated data type that defines what sort of information can be stored in it — thus 'name' is a field that can store a string of characters while 'telenum' is a field that can only store integers. The only problem left is how to specify which one of the fields is being refered to. The answer is once again to provide a two-part name consisting of the record name and a qualifier. In this case the qualifier is the name of the field separated from the record name by a '.'. So, we can write things like:

```
person.name="mike"
person.telenumber=123
```

In the same way that the array structuring principle can be applied twice to yield two-dimensional arrays a record can contain a field that is another record! For example, the record 'person' defined above could have a field called 'bday' that is itself a record —

```
RECORD  bday = day : string
               month : string
               year : integer
```

To refer to an element in bday it is necessary to use a doubly qualified name, as in the case of a two-dimensional array. For example

```
person.bday.year
```

gives the year that someone was born.

If this sounds interesting, now is the time to recall that most versions of BASIC don't support records! However, you can still use collections of strings and numeric variables with similar names as if they were records.

DYNAMIC DATA STRUCTURES

There is one class of data structures that can be added to BASIC by any programmer and, surprisingly enough, these are all dynamic data structures! The most important of these are the 'stack' and the 'queue' but there are others such as 'linked lists' and 'trees'. The trouble with describing these data structures is that if you've never wanted to use one it is difficult to see how they could be useful. However, if you don't know that they exist then there are some programs that, unless you re-invent the wheel, are very difficult to write.

The best known, and simplest, of all the dynamic data types is the stack. A stack is an area of storage that can be accessed through just two operations PUSH and PULL. PUSH stores and item on the stack and PULL retrieves an item from the stack. The more formal name for a stack, 'Last In First Out' or LIFO, gives a clue to the order in which a sequence of items PUSHed on the stack will be recalled by PULL operations. The best way ot visualise a stack is to imagine each item PUSHed onto the stack as being placed on the top of all the earlier items PUSHed onto the stack with a PULL operation always removing the topmost item. The last item to be PUSHed onto the stack is the first one to be PULLed off.

A stack is easy to implement in BASIC using a one-dimensional array and a single variable. The array is used to hold the items on the stack and the variable is used as a pointer to the current top of the stack. For example, to reverse three numbers easy:

```
10  DIM S(10)
20  LET P=1
30  FOR I=1 TO 3
40  INPUT N
50  LET S(I)=N
60  LET N=N+1
70  NEXT I
80  FOR I=1 TO 3
90  LET P=P-1
100 LET N=S(P)
110 PRINT N
120 NEXT I
```

Line 10 sets up the array to be used as the stack. Line 20 sets the variable P to 'point to' the top ofthe stack, in this case the top of the stack corresponds to the first free location in the array. Lines 50 and 60 form the PUSH operation. The number is stored in S(P) and then the pointer is incremented to point to the next free location. Lines 90 and 100 form the PULL operation and this should be easy to understand as it is similar to the PUSH operation.

That's all there is to implementing stacks and apart from worrying about PULLing data off the stack when there isn't any more and PUSHing more items on ▶

the stack than the size of the array allows there is nothing else to do. The most common application of stacks is in language processing, ie compilers etc. However, this is probably due to the fact that programmers who write compilers tend to know about stacks. In general a stack is useful whenever the order in which things have to be processed is different from the order in which they arrive.

QUEUING FOR IT

Once you have understood the idea behind a stack then a queue is just one step further on. The data structure called a queue mimics the behaviour of people queuing. A queue has a first person and a last person. People join the queue at the rear and leave the queue from the front. In the data structure called a queue the addition of data items happens at the rear and the retrieval of data items happens from the front.

The easiest way to implement a queue in BASIC is to use two pointers in place of the stack's one. The first pointer indicates the front of the queue and the second pointer indicates the end of the queue. In addition to these two pointers we can associate two new operations with every queue — JOIN and LEAVE. If F is the pointer to the front of the queue and R is the pointer to the rear then the two operations in BASIC are as follows:

```
JOIN

Q(R)=DATA
   R=R+1


LEAVE

DATA=Q(F)
   F=F+1
```

Thus the front of the queue moves relentlessly up the array, the trouble is — so does the rear! In order to stop the array having to be enormous you have to employ the extra trick of making the queue circular. If either of the pointers goes past the top of the array they are reset to point to the beginning of the array. The two operations now become:

```
JOIN

Q(R)=DATA
   R=R+1
   IF R>TOP THEN R=1


LEAVE

DATA=Q(F)
   F=F+1
   IF R>TOP THEN F=1
```

The queue starts off empty and the two pointers 'point' to the same place. This can be used to detect when the queue is empty. If after removing an item the pointers point to the same element of the array then the queue is empty. However, if this happens after an item has been ***added*** it means that the queue is full. The best way to find out how queues work is to dry run a queue on paper.

A program is part control structure, part data structure. If you select an inappropriate data structure then the program's control structure will be more complicated than it need be.

Data structures are important and in this brief introduction we have examined some of the elementary ideas involved. There is no doubt that the best way to learn about data structures is to use them creatively in actual programs — so experiment!

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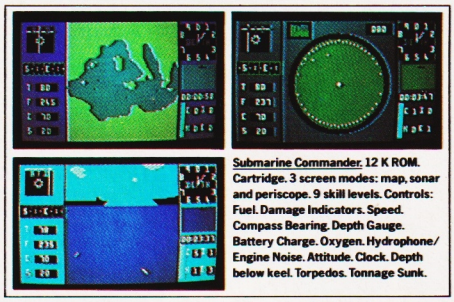

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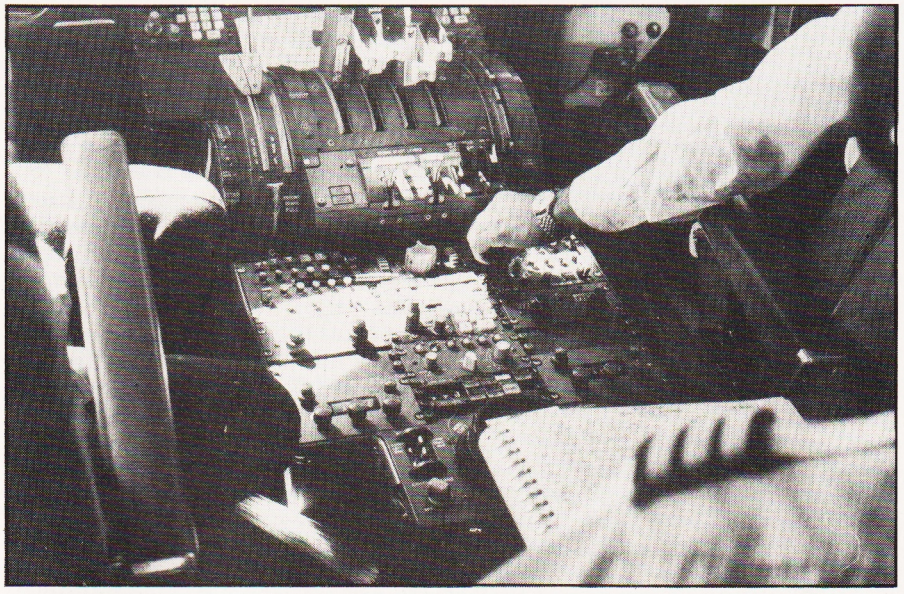
Just when you thought that it would be safe to come back to reading this column you find that the Editor's gone totally over the top . . .



Go West, young man — exhorted the American Government of the middle eighteen hundreds with the intention that the hitherto unsettled regions of their land would be peopled by a youthful and active society. Seldom has a campaign organised by a Government had such a long lasting effect on the development of a country!

I wasn't exactly following their advice when I checked in at Heathrow one miserable morning in late September, but I must confess that the sentiments were there because I was destined to visit some of the nth generation 'young men' whose efforts have resulted in one of the most spectacular growth industries to be found anywhere — micros!

GOING TO CALIFORNIA

If the weather in London was miserable, the 10½ hours of high altitude travel certainly took us over areas of the globe that would make London's weather look like the tropics. Greenland may look beautiful from 36,000 feet but it's certainly not very warm! One tip for all air travellers intent on taking photographs of the scenery whilst flying . . . don't bother doing it out of the cabin windows as the double layer of glass distorts your results more than a little. If, on the other hand, you manage to persuade the cockpit crew to do it for you you'll find that their windows are a little clearer, presumably so that they can see where they're going.

It turned out, sheer coincidence I'm sure, that our Captain was a micro owner himself with a TRS-80 Model III and all the bits. Seems strange really, talking about the oddities of doing random file accesses whilst hurtling across the sky some six and a half miles above *terra firma*. Then again, maybe it's not so strange when you consider that no-one is actually flying the 'plane; they don't just have one auto pilot these days but three inertial navigation systems all busily computing the position and direction of the aircraft. In fact, the whole trip turned out to be controlled by computer in one way or another. From the departure lounge displays at Heathrow to the arrivals boards on my return some 10 days later almost every waking, and even some sleeping, moments had, in one way or another, computing overtones.

This feature is not intended to be a travelogue of the USA but rather an extremely tongue in cheek look at the extent to which the micro has invaded the day to day life of your average American (assuming that there is such a thing as an 'average' American). Indeed, quite apart from recharging the Editor's flat batteries in the sunshine, the visit was intended to include a trip around the legendary Silicon Valley area.

AN AMUSING DIVERSION

Probably the first place any fun-loving tourist makes for on their arrival in California is one of the great 'theme parks' and as the closest to the airport is Universal Studios, that seemed as reasonable a place to start as any. Quite apart from the hours of innocent fun that the public see is the daily work going on behind those giant doors of the sound and special effects stages, much of which is nowadays dependant on the computer. It is probably true to say that without the availability of computer technology, no matter how good the models and the matté artists' overlays, films such as *Tron* and *Battlestar Galactica* or *Blade Runner* and *Alien* simply wouldn't have worked.

The trip through Universal City now includes a specially constructed Special Effects Stage where some of the techniques used are explained and, almost as an afterthought, they give you a very brief look at some computer animation (perhaps it's time they updated this section).

One place that hasn't been slow to update its 'amusements' is Disneyland, still the jewel in the crown of all theme parks. The trick here is to try to spot the computers (no mean feat in itself) but once you have located the control booth for each of the rides, you'll generally spot a terminal in almost constant use. If you happen to go there in the near future and pass by the Matterhorn roller coaster, look up into the window of the Alpine chalet above you and you'll see what mean. Sadly, I wasn't able to penetrate further into the Disney organisation but with the opening of the new EPCOT centre in Florida due any day now, almost entirely populated by Disney's Audio-animatronics and controlled by computer, perhaps a Special Report might be in order . . . ▶

AND SO TO WORK

Sadly, of course, the fun always has to end and as Silicon Valley is only a quick flight away, that's where we go next. The state of American airline computerisation is far and away more thorough than even our best efforts here. Mainly, this is due to the fact that in the USA there is effectively no integrated public transport system and, as California is roughly the same sort of size as England, this leaves flying as the only viable option. You might think that you could let the train take the strain, but when you find that they only run one a day between Los Angeles and San Francisco (and one the other way) you begin to think that BR don't do such a bad job after all! To add to this problem, America still languishes under the gas conservation regime and a speed limit of 55 MPH is, for someone used to motorway speed limits, almost intolerable!

No, when you realise that flying from place to place is as easy as buying an Inter City train ticket and just as cheap provided you shop around, you casually join the commuters jet hopping from town to town. All this is made considerably easier by the use of one's plastic money, especially when your card can be automatically checked down the 'phone quicker than the ground stewardess can get her desktop terminal to print out your ticket! If you've ever wondered what that little black strip on the rear of your 'major' credit card was for, now you know! Plans are afoot to bring this technology to the UK I gather and, as far as I can see, the sooner the better. Mind you, electronic fund transfer, or EFT for short, does have one problem . . . the bills tend to arrive quicker!

Silicon Valley is no longer the exclusive little gathering of the leaders of High Technology that it used to be. Almost every compnay that makes or supports electronics and computers seems to have an office there now. Even the local maps supplied by San José to its tourists carry a roll call of firms they are plesed to welcome to their flock. Among these were two of the more household names in micros, both of whom I intended to visit: Commodore and Apple.

The manufacturing facility of Commodore's US operation is based at Santa Clara, a short ride out from downtown San José. Housed in an 'interestingly shaped' building which is almost totally solar heated and cooled (they've got enough sun to be able to) there is surprisingly little to see. Their main 'build' at the time I was there was the Commodore 64, although they were only producing units for the US market at that stage. Eventually all the UK and European boards will be made up there as well before being shipped to Germany for final assembly. Row upon row of the sleek grey boxes were racked up along the walls undergoing their soak testing and final checks while still more were being assembled back down the line. In comparison with this hive of activity, the rest of the plant is almost quiet. Floppy drives are assembled here, and so are the 4000 and 8000 series machines although these will be gradually phased out with the introduction of the 500 and the 700 machines. On the day of my visit, the plant had just received the working drawings for the 500 series which they reckoned would take six to nine weeks to bring into production for the US market, obviously longer for Europe. The 700 series machines were estimated to be about the same period again behind.

All the facilities of the plant are operated by some 250 staff from managers to shop-floor workers. None of the peripherals, except discs, are made in the USA and neither is the new low-cost machine we'll know as the VIC-10. Commodore have also shifted production of the VIC-20 to their R&D facility in Pennsylvania which supplies the world, no European construction apparently.

For those who have been around micros for a few years, the final tale from Commodore might bring back memories of those days when BASIC was an add-on extra. Some weeks before I visited the plant, they were doing a stock check of the components and found that they had a quantity of parts ready sorted for a simple system called the KIM, remember them? Not wishing to be wasteful they checked with Marketing who assured them that they could sell all that they made with the result that the last 450 KIMs ever rolled off the production line during September 1982. Some of you may now be racking your brains to try to realise the significance of this so if I told you that the earliest reference I could find to the KIM is an article in the April 1976 issue of *BYTE,* you might begin the grasp the antiquity of the beast! It originally used to sell for around $250; that didn't include a power supply, and comprised a 6502, a 2K monitor in ROM, 1K of RAM plus a combined I/O device which had 128 bytes of scratchpad memory and gave serial and parallel ports. Programming was achieved by a Hex keypad and six LED displays and the results could be saved on tape. If anyone can actually come up with the name of another system which has a production history as long as the KIM's I would very much like to hear from them!

Wall-to-wall Commodore 64s undergoing their 24 hour soak testing. The mobile trolley is connected to each unit in turn.

FINAL DIVERSIONS

I mentioned earlier that I had intended to visit Apple but owing to a communcation breakdown this, sadly, never materialised. Still, there's always next year . . .

Travelling around in California, by car this time, I located, totally by chance, the Sirius plant. Off Highway 17, just

outside Santa Cruz, it proved totally inaccessible which was more than a little frustrating. Even more annoying was the realisation that with only two days to try to see the whole of the area, I simply wasn't going to manage to visit as many places as I'd hoped.

After leaving the confines of Silicon Valley, or Silicone Valley as the publicity brochure supplied by my hotel insisted on calling it, the rest of the trip dissolved into a pleasant suntanning session but even under these relaxed circumstances, the old micro kept on cropping up. On passing the door of a neighbouring hotel (breakfast in America tends to be a 'go and get it' affair) my attention was drawn by an Apple sitting on the reception desk. It proved to be used for billing the guests, recording whether they wanted early morning calls and all the other mundane chores that a hotel has to handle to ensure the comfort of its clients. The interesting thing though was the attitude of the staff, who treated it as part of the furniture rather than a special piece of equipment. Now, in the bigger hotel chains the whole place seems to be computerised, even down to the door locks on the bedrooms and you expect this, but a 30-room downtown hotel? Still, as they say, that's America for you.

And, talking about sayings, let me warn you about the local breed of cash register. Huh, you say, has he flipped? No, in America, you may well be greeted by cash registers that do nasty things to you, like talk. Now, coping with one that prints 'Have A Nice Day' at the bottom of every bill is bad enough, but one that spells out the cost of each item and then recites that awful phrase is almost too much to take! I supposed that eventually we'll inherit this ultimate piece of crassness, but please don't let it be soon.

And, having reached the logical end of this month's feast of words, it only remains to thank those people who tolerated my presence. In no particular order, my trip would have proved impossible without the aid of Captain Pat Ternan and his crew on BA 282, Lydia King and Ralph Burgess at Commodore, Rene Olsen at Apple and the unidentified crew of BA 283 who took us on a 40-minute round trip of Los Angeles airport and gently brought us back!

Above: Commodore's solar heated and cooled facility.
Below: At least this cash register didn't talk to me!▼

```
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   TTL NO TX        21.45
LUCERNE MILK          .99*
   TOTAL            22.64
   CASH TEND        50.00

   SUBTOTAL         22.44
   TAX PAID           .20

27.36 CHANGE

    HAVE A NICE DAY
```

The other end of the line where all the hand assembly is carried out. The test racks can be seen at the far end.

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Your Computer, May '82

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2 extracts from ZX Computing, Oct/Nov '82

CASSETTE 1

(eleven 1k programs)

machine code:
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Ten games in Basic for 16k ZX81

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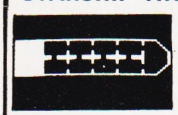
CASSETTE 3

8 programs for 16k ZX81

STARSHIP TROJAN



Repair your Starship before disaster strikes. Hazards include asphyxiation, radiation, escaped biological specimens and plunging into a Supernova.

STARTREK This version of the well known space adventure game features variable Klingon mobility, and graphic photo torpedo tracking.
PRINCESS OF KRAAL
An adventure game.
BATTLE Strategy game for 1 to 4 players.
KALABRIASZ World's silliest card game, full of pointless complicated rules.
CUBE Rubik Cube simulator, with lots of functions including 'Backstep'.
SECRET MESSAGES This message coding program is very txlp qexi jf.
MARTIAN CRICKET A simple but addictive game (totally unlike Earth cricket) in machine code. The speed is variable, and its top speed is very fast.
Cassette 3 costs £5.

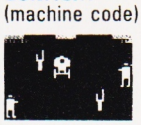
CASSETTE 4

8 games for 16k

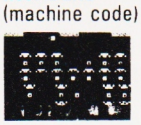
ZX-SCRAMBLE (machine code)

Bomb and shoot your way through the fortified caves.

GUNFIGHT (machine code)



INVADERS (machine code)



FUNGALOIDS (machine code)
GALAXY INVADERS (machine code)
Fleets of swooping and diving alien craft.
SNAKEBITE (machine code)
Eat the snake before it eats you. Variable speed (very fast at top speed)
LIFE (machine code)
A ZX81 version of the well known game.
3D TIC-TAC-TOE (Basic)
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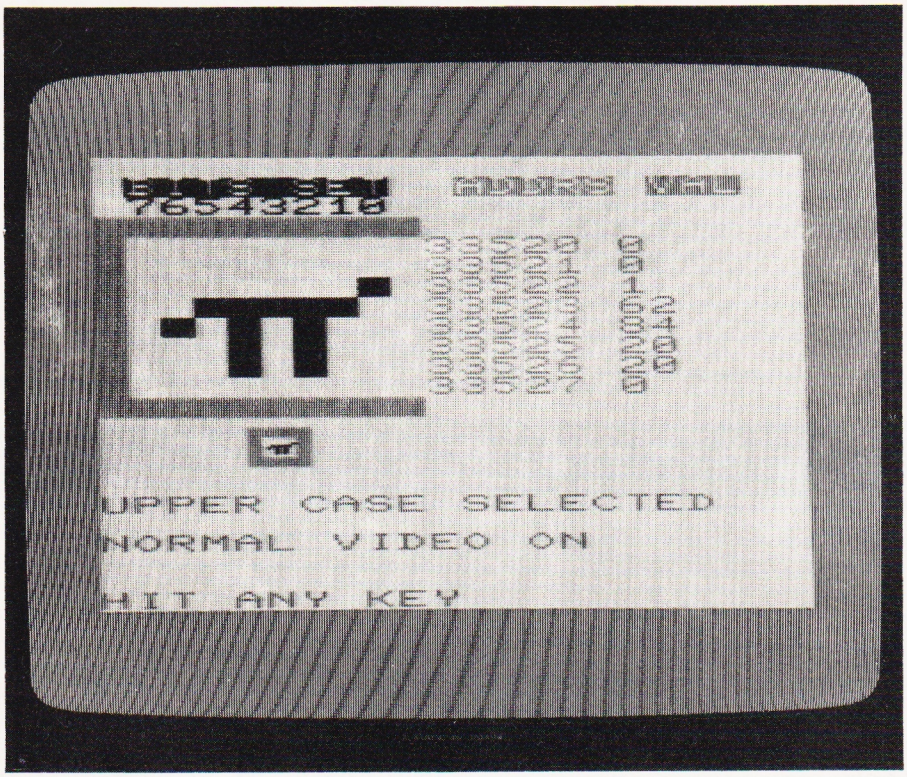
Chris Wyatt

VIC BLOW-UP

If you've ever wondered just how the characters your computer displays are made up then this program will reveal all.



One of the nicest things about Commodore's microcomputers is the ready-made graphics set that comes as standard with their machines. The VIC-20's character set is probably the best within the existing range, so I thought it might be interesting to have a look at exactly how the VIC sticks its pixel dots together to make up what is really a rather friendly set of characters.

THE SHAPE OF THINGS TO COME

As you doubtless already know, the VIC screen display is made up of 23 rows of 22 characters per row, giving a total of 506 character positions in all.

Each of these character positions can itself be divided up into eight rows of eight pixels per row — a pixel being the smallest area of the screen that can be individually controlled. On the VIC these pixels are rectangular, with a width to height ratio of approximately 3 to 2. Since the complete character position is, as we said, built up in eight rows of eight pixels, then this too will be rectangular in the same proportions.

Thus, if you were able to magnify an individual pixel eight times you would find yourself looking at a normal size 'Reverse Space' character.

This technique is used by the program to 'blow-up' any of the characters within the VIC's ROM held character set by magnifying each of the 64 pixels making up the character.

THE PROGRAM TECHNIQUE

The program works by identifying the location in ROM character generator of a character typed in at the keyboard. The eight bytes holding the character 'shape information' are then retrieved from the character generator, and the 'bit-pattern' translated into eight rows of eight full character positions on the VIC's screen display. A 'Reverse Space' character is used to represent a pixel 'set'; a normal 'Space' for a pixel not set.

The screen thus displays the exact arrangement of pixels as used in the formation of the normal size character — only eight times bigger. The screen also displays the memory locations of each of the eight bytes used for the character, and the values stored in those locations — both in decimal. All of the VIC character set is accessible, including all upper and lower case alpha-numerics and graphics, plus all 'reverse video' forms. The mode in which the program is currently operating, ie:

1) Upper case/normal video
2) Upper case/reverse video
3) Lower case/normal video
4) Lower case/reverse video

is continuously displayed. Switches between the various modes — upper to lower case, reverse video on and off — are made in the usual ways, which if you're not sure about them, are:

1) Change from upper to lower case and back — press Shift and 'Commodore' keys together.
2) Change to reverse video — press 'CTRL' and 'RVSON' together.
3) Change back to normal video — press 'CTRL' and 'RVSOFF' together.

Invalid entries from the keyboard, eg 'Return', 'INST/DEL', 'function keys', etc, are error-trapped. The program does not crash, but can be interrputed by pressing the 'RUN/STOP' key.

The listing is short enough not to tax even the most weary fingers, and the full *Computing Today* standards have been adhered to without.

If you're into re-defined character generators the program provides a quick and easy method of identifying the memory location of all the VIC's 'off the peg' characters for transferring into your own character generator as required.

Even if you're not a graphics freak, I think you'll find

discovering how Commodore designed the VIC's excellent character set an entertaining experience in itself.

PROGRAM NOTES

The program is written in BASIC for the unexpanded VIC-20, but the following notes, together with the accompanying program description and Table 1, should enable the listing to be converted to any micro with a similar type of character generator.

The VIC screen display is controlled by two separate areas of memory. The first, starting at 7680 decimal, is used to contain the character or POKE code, whilst the second, starting at 38400 decimal, contains the code for the colour of the screen position. Thus:

```
POKE 7680,1:POKE 38400,0
```

causes a black A to be displayed at the top left corner of the screen — 1 being the character or POKE code for an A, and 0 being the colour code for Black. Address 36879 controls the background/border colour combination. Address 36874 controls the pitch of the first tone generator of which the VIC has three, plus a white noise generator and address 36878 controls the volume of the sound generators.

Address 36869 is one of the busiest addresses in the VIC, and a full description of everything it does would take up an article in itself. Suffice it to say that in this program, if it contains 240 decimal then the VIC is working in upper-case; if 242 then lower-case has been selected.

Finally, besides POKEing characters onto the screen, the VIC has a particularly powerful PRINT command. The horrendous looking line 290 is a good example of the flexibility of the VIC PRINT statement. The listing uses the *Computing Today* standards for representing graphic and cursor control statements, so for those with the stomach for it, this is what line 290 actually does.

The cursor is first HOMEd to the top left of the screen as a starting reference point. It is then moved down 13 rows and across four columns. The cursor colour is set to Green and then three graphic symbols — a 'bottom right-hand quarter block', a 'bottom half bar', and a 'bottom left-hand quarter block' — are PRINTed. The cursor is now moved down one row and back left three columns, reverse video is turned on, and a reverse 'left-hand bar' symbol (ie a 'right-hand bar') is PRINTed. Normal video is restored, the cursor moved one column to the right, and a 'left-hand bar' symbol PRINTed. Now the cursor goes down one row, back left three columns, and a 'top right-hand quarter block' is PRINTed. Turn reverse video back on, PRINT a reversed 'bottom half bar', revert to normal video and PRINT a 'top left-hand quarter block'. Move the cursor up one row and back left two columns, and then change the cursor colour to Black. Now PRINT the contents of CS$ (RVSON or RVSOFF) and then the character held in A$. Finally, change the cursor colour to Blue. And all on one line . . . Phew!

PROGRAM DESCRIPTION

Lines 10-20	Set border colour to Blue/background to White and clear screen.
Lines 30-110	Loop displaying current operating mode and testing for mode changes and/or single character inputs by user.
Line 120	PRINT single character input at top left of screen.
Lines 130-140	Get POKE code of character by PEEKing top left of screen; check input is a 'printable' character and if not, branch to error trap at line 310
Line 150	If input is a reverse video character, add 128 to POKE code.
Line 160	Locate start of shape tables for required character; initialize character and colour video RAMs.
Line 170	If a lower case character, redirect to lower case shape tables.
Lines 180-280	MAIN DISPLAY: Print magnified version of character by converting bit patterns from shape tables into patterns of full-size Reverse Spaces. Print the eight addresses containing the shape information and the values, in decimal, held in them.
Line 290	Print the input character at normal size within a Green border.
Line 300	Hand back to keyboard control loop.
Lines 310-360	Error trap — Clear screen, turn whole screen Red, sound audible alarm, advise of error, pause and resume program.

A$	Single character input by user
CH	POKE code of A$
CS$	Indicates normal or reverse video selected
CA	Indicates upper or lower case selected
CS	Pointer to character generator shape tables
CT	Character video RAM location
CO	Colour video RAM location
I	Counter used to point to each of the eight addresses containing the character shape information.
J	Counter used to point to each of the eight bits in each address containing the character shape information.
VL	Value held in each of the addresses containing the character shape information.
MX	Used as a reference value in conversion of the character generator bit patterns to the 'magnified' display
X	Delay loop counter in error trap routine.

Table 1. The variables used within the Blow-Up program and their functions. ▶

```
 10  POKE 36879,30
 20  PRINT "[CLS]"
 30  PRINT "[HOM][22 CD]HIT ANY KEY";
 40  IF CS$="[REV]" THEN PRINT "[HOM][19 CD][REV]REVERSE
     VIDEO ON [OFF]":GOTO 60
 50  PRINT "[HOM][19 CD]NORMAL VIDEO ON"
 60  IF PEEK(36869)<>CA THEN PRINT "[CLS]";
 70  IF PEEK(36869)=242 THEN PRINT "[HOM][17 CD]LOWER
     CASE SELECTED":CA=242:GOTO 90
 80  PRINT "[HOM][17 CD]UPPER CASE SELECTED":CA=240
 90  GET A$:IF A$="" THEN 30
100  IF A$="[REV]" THEN CS$="[REV]":GOTO 20
110  IF A$="[OFF]" THEN CS$="[OFF]":GOTO 20
120  PRINT "[HOM]";A$
130  IF A$<>"[SPC]" AND PEEK(7680)=32 THEN GOTO 310
140  CH=PEEK(7680)
150  IF CS$="[REV]" THEN CH=CH+128
160  CS=32768+CH*8:CT=7747:CO=38467
170  IF PEEK(36869)=242 THEN CS=34816+CH*8
180  PRINT "[CLS][HOM][CD][CR][REV][CTL BLK]BITS SET
     [OFF][2 SPC][REV][CTL PUR]ADDRS[OFF][SPC][REV]
     [CTL BLU]VAL[OFF]"
190  PRINT "[CR][CTL BLK]76543210":PRINT "[REV][CTL GRN]
     [10 SPC][OFF]"
200  FOR I=0 TO 7
210  VL=PEEK(CS+I):MX=128:CT=CT+22:CO=CO+22
220  FOR J=0 TO 7
230  IF VL<MX THEN 250
240  POKE CT+J,160:POKE CO+J,0:VL=VL-MX
250  MX=MX/2
260  NEXT J
270  PRINT "[REV][CTL GRN][SPC]"TAB(9)"[OFF][CTL PUR]"
     CS+I"[CTL BLU][CL]"PEEK(CS+I)
280  NEXT I:PRINT "[REV][CTL GRN][10 SPC][OFF][CTL BLU]"
290  PRINT "[HOM][13 CD][4 CR][CTL GRN][G<D][G<I][G<F]
     [CD][3 CL][REV][G<K][OFF][CR][G<K][CD][3 CL][G<C]
     [REV][G<I][OFF][G<V][CU][2 CL][CTL BLK]"CS$;A$:
     PRINT "[CTL BLU]"
300  GOTO 30
310  PRINT "[CLS]";:POKE 36879,42:POKE 36878,15:PRINT
     "[6 CD][CTL WHT][6 CR]ERROR"
320  PRINT "[3 CD][2 CR]NOT A PRINTABLE":PRINT "[4 CR]
     [CD]CHARACTER[CTL BLU]"
330  POKE 36874,200
340  FOR X=1 TO 2000:NEXT
350  POKE 36874,0
360  GOTO 10
```

The complete Blow-Up program listing in VIC BASIC. Note that *Computing Today* conventions are used throughout.

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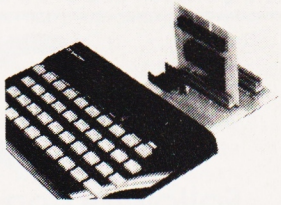

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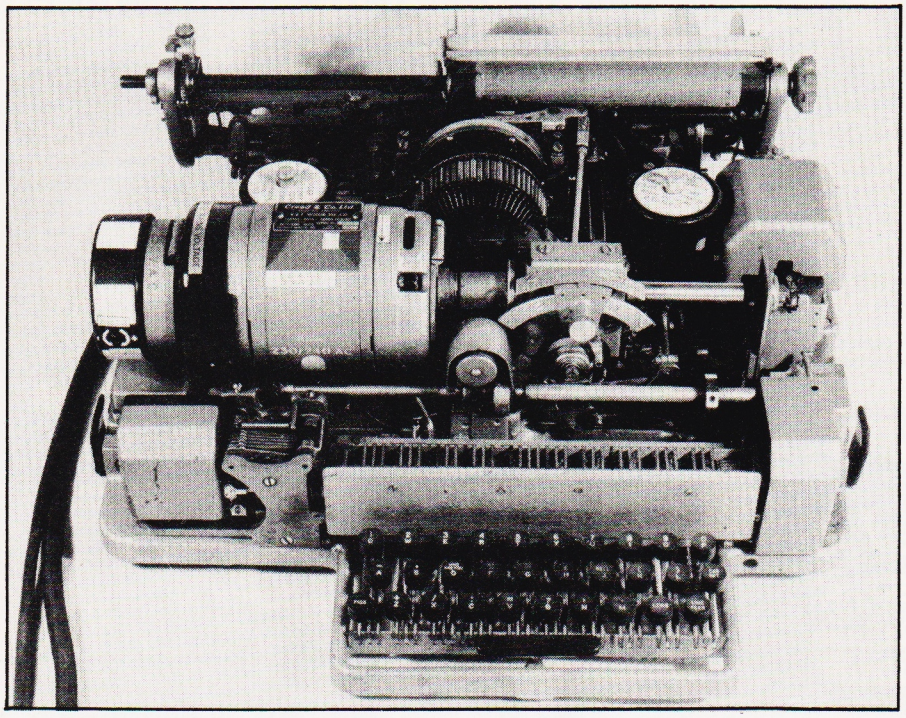
CHEAP PRINT

Following on from last month's article on connecting an ultra-cheap printer to your micro we conclude with the necessary software.



This chunk of software allows a cheap Telex coded (five-bit) Teleprinter to be used as a printer by a NASCOM computer. The hardware was covered in last month's issue, the interface circuit given then was kept simple, and hence cheap, by doing the complicated bits in software.

This program requires NAS-SYS 1 or 2, and will run directly on a NASCOM 1 or 2. It is completely relocatable without any alteration necessary. It may be burned into an EPROM and bunged into any spare socket (early NASCOM 2s have spare sockets) or you can stick it in whatever bit of RAM you are not using. Great pains have been taken to ensure compatibility with other NASCOM software, so that the printout from within BASIC, Naspen, etc is not only possible but convenient.

The assembler listing is provided for those who wish to understand, modify, or re-write the program, perhaps for a different computer, see Listing 1. If machine code is not your thing and you just want to use the program, it is also given in Hex dump form for easy entry, see Listing 2. Sorry, this is one of those things that just can't be done in BASIC. Note that the addresses given are 'fictional', they are provided for reference only. You can enter the program wherever you wish from address 1020 Hex onwards. The best place to put it is at the far end of the memory, out of the way, or in EPROM. Addresses before 1020 Hex are used for various purposes by the system's software and are best left alone.

FIRST LOAD YOUR CODE

Once the program is on board, it should be executed to set up all the output vectors for the different utilities. A vector is a sort of detour, where the monitor, say, deliberately jumps to a RAM location (where it normally finds an instruction telling it to jump back) on its way to outputting a character to the VDU output routine. This useful feature is quite sophisticated on the NASCOM, with separate vectors for ZEAP and Naspen. When using either of these, they should be initialised first, then Gadabaud, followed by a warm start on Naspen or ZEAP otherwise the initialisation of Naspen or ZEAP after Gadabaud would wipe out the Gadabaud vectors. For the same reason, it is necessary to re-initialise Gadabaud after a reset.

Print output does not begin with the initialising of the vectors, however, as these vectors also incorporate a software switch. This allows the print to be turned on and off by the instructions within a program, which is very useful when you wish, for instance, to have prompts appear on the VDU with only the results of calculations or whatever printed out. Naspen and ZEAP have their own print commands which work with Gadabaud after initialisation. BASIC uses the monitor's vector via the monitor's U and N functions, which can be set by DOKEs within BASIC programs to turn print on and off. Gadabaud can also be initialised from within BASIC, see Listing 3.

KEEPING TIME

The output timing for each bit is carried out by a delay loop within the routine. Obviously this loop will be executed faster in a NASCOM running at 4 MHz than in one running at 2 MHz. Therefore, it is necessary to set the delay bytes to the appropriate figure for your operating speed. These are marked on the Hex dump. The bytes should be: 4 MHz = 1350, 4 MHz with Wait States = 1070, 2 MHz = 0BF0. These bytes can be fine tuned by altering the second byte in the pair if need be. Not all Teleprinters operate at 50 baud, indeed some are adjustable, but the above figures will suit the common 50 baud machines. The commonest problem in implementing this program, which is already in use by a number of NASCOM owners, is the use of the wrong delay bytes, resulting in garbage printout. The second commonest is connecting to the wrong pin on the keyboard header plug, which may result in garbage or no print at all! Due attention to these two points will almost guarantee success.

The only other modification which will be necessary is if you are running NAS-SYS 3. This uses

different I/O tables from the original NAS-SYS and in the Hex dump address 0027 should be changed from 7F to 79 and address 002D from 82 to 7C.

Owners of other computers may wish to re-write the program for their own machines. Such an undertaking could be arduous, but it is certainly possible. Indeed, the core of this program started life in a 8080-based Triton. (see November 1979's ***Computing Today***). Conversion for use in another Z80 or 8080 based computer will obviously be easier than for a microprocessor with a completely different instruction set, as that would entail a working knowledge of two instruction sets, not an attribute possessed by many of us. The following notes will aid the experienced machine code worker to adapt the program.

MAKING CHANGES

The assembler listing gives a great deal of information but a few points need embellishment. The NAS-SYS monitor allows a 'relative call' instruction to be used. This is similar to the relative jump instruction in the Z80 instruction set, but is actually a NAS-SYS subroutine accessed by the D7 restart instruction. This facility will probably not be available on other machines. The easiest solution would be to abandon relocatability and go back to absolute addressing with normal jumps and calls. Lines 0120 to 0450 are concerned with setting up the various NASCOM vectors. Similar routines to link with your own vectors, (also called reflections) should be substituted. Lines 0460 to 0510 set up the program's variables in RAM at 0EE0 to 0EE5 Hex. These locations are referred to later in the program, so if you use different addresses, remember to change them everywhere they appear. The pound sign, (£), should in fact be a dollar sign, but the dollar symbol is not available on British Teleprinters (proof, if needed, that the listing is a direct dump). This is one of the character substitutions which takes place in the look-up table. More complex substitutions are made in lines 0700 to 0910 to make up for deficiencies in the Teleprinter character set. Lines 0580 to 0610 cause lower case to print as upper, since lower case is not available. Lines 0620 to 0690 prevent double spaced lines on the NASCOM, as the output section, 'BAUDOUT' at 0920, automatically Line Feeds after a Carriage Return. Whether you will need this depends on your machine. Early NASCOMs, for instance, used a single code for 'Newline' which gave both Carriage Return and Line Feed when sent to the VDU. The later NASCOM monitors sent separate codes for Return and Line Feed, so the 'extra' Line Feed had to be supressed. The routine will give a Line Feed for either codes 0A or 1B, and code 0D will give both Carriage Return and Line Feed. This is accomplished in the portion of the assembler listing from 1780 to 1900, which also provides extra delay time to allow the movement of the paper carriage to take place.

The routine SUB6 at line 1440 is the one bit delay loop. SUB 3 from 1520 to 1650 takes care of the Teleprinter's letters/figures case shift, which is sent as a character. SUB 7 at 1130 to 1310 serialises the output of each character. SUB 4 and 5 from 1320 to 1430 output the individual bits to the port. Part of this routine sets a memory location which tells NAS-SYS the status of the port, which will not be needed on other machines (1350 to 1410). SUB 2 looks up the Teleprinter code in the look-up tables and links with the special Line Feed and Carriage Return routines. If it cannot find a character in the table, it defaults to a space. SUB 1 decides if a case shift is required. The first part of BAUDOUT from 0930 to 1060 merely saves and restores the registers and keeps track of which case the Teleprinter is in by storing a marker in RAM. This may be regarded as the entry point of the output routine proper. Calling this address will result in the output in five-bit code of the ASCII code in the accumulator, and the routine terminates with a return instruction.

HAROLD'S BANE

The look-up table will appear clumsy to the knowledgable, as it does not use the more usual method employing the address of a byte as the alternative code for the code stored in that byte. That method would have hindered relocatability, however, without saving much space, and besides, I didn't think of it! The table is arranged so that each Telex character precedes the equivalent ASCII character. The program just steps through until it gets a match or finds the end marker (FF). This table can be extended if desired to provide near equivalents for characters not in the Telex set. The table already supplies a colon for a semi-colon, apostrophe for quotation marks, pound sign for hash as well as dollar, and an @ for multiplication. It may be seen that the Telex codes are not in order like the ASCII codes are. This is because this code dates from a time when the only text storage 'memory' available was paper tape. In order to keep the tape as strong as possible, the code was arranged so that the letters which were used most often put the fewest holes in the tape. Nowadays much of the Telex traffic is handled by modern computers with disc storage and high speed printers, but the transmission code and speed remain the same, at least at local level. As with the telephones, a widespread standard is very difficult to change. It should be noted that the hexadecimal representation of the five bit code is of my own construction, to allow it to be handled by the computer. Properly speaking, there is no parallel notation for this code. It is serial only, and when it is written down, as in Fig. 1, it is always in terms of mark and space signals or holes in tape. However, this can obviously be viewed as binary and represented in Hex. An offset of 80 Hex has been added to the letter codes to distinguish them from the figures so that the program can keep the Teleprinter in the correct case.

LETTERS	5	4	3	2	1	FIGURES
A	o	o	o	●	●	-
B	●	●	o	o	●	?
C	o	●	●	●	o	:
D	o	●	o	o	●	WRU
E	o	o	o	o	●	3
F	o	●	●	o	●	%
G	●	●	o	●	o	@
H	●	o	●	o	o	£
I	o	o	●	●	o	8
J	o	●	o	●	●	BELL
K	o	●	●	●	●	(
L	●	o	o	●	o	)
M	●	●	●	o	o	.
N	o	●	●	o	o	,
O	●	●	o	o	o	9
P	●	o	●	●	o	0
Q	●	o	●	●	●	1
R	o	●	o	●	o	4
S	o	o	●	o	●	'
T	●	o	o	o	o	5
U	o	o	●	●	●	7
V	●	●	●	●	o	=
W	●	o	o	●	●	2
X	●	●	●	o	●	/
Y	●	o	●	o	●	6
Z	●	o	o	o	●	+
SAME IN BOTH CASES-	o	●	o	o	o	CARRIAGE RETURN
	o	o	o	●	o	LINE FEED
	●	●	●	●	●	LETTER SHIFT
	●	●	o	●	●	FIGURE SHIFT
	o	o	●	o	o	SPACE
	o	o	o	o	o	NULL CYCLE

O=SPACING, ●=MARKING (HOLE IN TAPE)
.= FEED HOLES IN TAPE

Fig. 1. The International five unit Teleprinter code shown in its 'parallel' or paper tape format.

The effect of the output instruction in line 1420 is to turn one bit of an output port on or off. This one-bit port is all the hardware needed in the computer ▶

to drive the simple interface circuit used. In the NASCOM, this is an unused bit on the keyboard port, and many computers will have a bit going spare somewhere which can be used. This should consist of a simple 5 V latch, a port with formatting, handshaking, timing, or serialisation in hardware, such as RS232, is not suitable.

DATA FORMAT

The format of the output is one start bit (space), five data bits, and two stop bits (mark). There should really be only one and a half stop bits, but the added complexity did not seem worthwhile. Mark and space are inverted to give a 5 V space and 0 V mark as far as the computer output is concerned. This is converted to the correct bi-directional voltage by the interface circuit anyway, and by arranging things this way we avoid having the teleprinter clacking away printing nothing if it is turned on with no signal being sent to it. After all, we never said that a cheap printer had to be quiet!

```
ZEAP Z80 ASSEMBLER - SOURCE LISTING

                        0010 : GADABAUD FOR NASCOM 2 WITH NAS-SYS 1,
                        0020 : BITS AND P.C.S PROGRAMMER'S AID,
                        0030 : NASPEN AND ZEAP.
                        0040 :
                        0050 : BAUDOUT ROUTINE BY IOLO DAVIDSON
                        0060 :
                        0070 : INITIALIZATION AND TRAP ROUTINES BY
                        0080 : J.D. EDWARDS 14/09/80 AND 01/08/81
                        0090 :
                        0100 : VER 1.3 FOR UNMODIFIED CREED 7E
                        0110 :
C000                    0120        ORG  £C000
C000                    0130        ENT
                        0140 : INITIALIZATION ROUTINE
C000 D702               0150        RCAL INIT
C002 DF5B               0160        SCAL £5B
C004 F5                 0170 INIT   PUSH AF
C005 E5                 0180        PUSH HL
C006 D5                 0190        PUSH DE
                        0200 : CALL TO GET PC ON STACK
C007 D700               0210        RCAL LOCN
C009 E1                 0220 LOCN   POP  HL
                        0230 : ADDRESS OF OUTPUT TRAP ROUTINE
C00A 113F00             0240        LD   DE,TRAP-LOCN
C00D 19                 0250        ADD  HL,DE
                        0260 : USER OUTPUT REFLECTION
C00E 22780C             0270        LD   (£0C78),HL
                        0280 : ZEAP OUTPUT REFLECTION
C011 22050F             0290        LD   (£0F05),HL
                        0300 : ADDRESS OF LOOK-UP TABLE
C014 11D700             0310        LD   DE,TABLE-TRAP
C017 19                 0320        ADD  HL,DE
C018 22E40E             0330        LD   (£0 E4),HL
                        0340 : NASPEN OUTPUT REFLECTION
C01B 21DF75             0350        LD   HL,£75DF
C01E 221D10             0360        LD   (£101D),HL
C021 3EC9               0370        LD   A,£C9
C023 321F10             0380        LD   (£101F),A
                        0390 : I/O TABLES AND REFLECTIONS
C026 217F07             0400        LD   HL,£077F
C029 22730C             0410        LD   (£0C73),HL
C02C 218207             0420        LD   HL,£0782
C02F 22750C             0430        LD   (£0C75),HL
C032 212F00             0440        LD   HL,£002F
C035 227B0C             0450        LD   (£0C7B),HL
                        0460 : CASE AND LAST CHARACTER
C038 21FFFF             0470        LD   HL,£FFFF
C03B 22E00E             0480        LD   (£0EE0),HL
                        0490 : TIMING BYTES: COARSE IN L, FINE IN H
C03E 211350             0500        LD   HL,£5013
C041 22E20E             0510        LD   (£0EE2),HL
C044 D1                 0520        POP  DE
C045 E1                 0530        POP  HL
C046 F1                 0540        POP  AF
C047 C9                 0550        RET
                        0560 : OUTPUT TRAP ROUTINE
C048 F5                 0570 TRAP   PUSH AF
                        0580 : CONVERT LOWER CASE TO UPPER
C049 CB77               0590        BIT  6,A
C04B 2802               0600        JR   Z,TRA10
C04D CBAF               0610        RES  5,A
                        0620 : SUPPRESS LF AFTER CR
C04F FE0A               0630 TRA10  CP   £0A
C051 200B               0640        JR   NZ,TRA20
C053 3AE10E             0650        LD   A,(£0EE1)
C056 FE0D               0660        CP   £0D
C058 2824               0670        JR   Z,TRA70
C05A 3E0A               0680        LD   A,£0A
C05C 181E               0690        JR   TRA60
                        0700 : PRINT LT FOR LESS THAN
C05E FE3C               0710 TRA20  CP   £3C
C060 2006               0720        JR   NZ,TRA30
C062 3E4C               0730        LD   A,£4C
C064 D71D               0740        RCAL BOUT
C066 1808               0750        JR   TRA40
                        0760 : PRINT GT FOR GREATER THAN
C068 FE3E               0770 TRA30  CP   £3E
C06A 2008               0780        JR   NZ,TRA50
C06C 3E47               0790        LD   A,£47
C06E D713               0800        RCAL BOUT
C070 3E54               0810 TRA40  LD   A,£54
C072 1808               0820        JR   TRA60
                        0830 : PRINT @@ FOR UPWARD ARROW
C074 FE5E               0840 TRA50  CP   £5E
C076 2004               0850        JR   NZ,TRA60
C078 3E2A               0860        LD   A,£2A
C07A D707               0870        RCAL BOUT
C07C D705               0880 TRA60  RCAL BOUT
C07E F1                 0890 TRA70  POP  AF
C07F 32E10E             0900        LD   (£0EE1),A
C082 C9                 0910        RET
                        0920 : BAUDOUT ROUTINE
C083 E5                 0930 BOUT   PUSH HL
C084 C5                 0940        PUSH BC
C085 F5                 0950        PUSH AF
C086 3AE00E             0960        LD   A,(£0EE0)
C089 4F                 0970        LD   C,A
C08A F1                 0980        POP  AF
C08B F5                 0990        PUSH AF
C08C D708               1000        RCAL SUB1
C08E 79                 1010        LD   A,C
C08F 32E00E             1020        LD   (£0EE0),A
C092 F1                 1030        POP  AF
C093 C1                 1040        POP  BC
C094 E1                 1050        POP  HL
C095 C9                 1060        RET
C096 D75C               1070 SUB1   RCAL SUB2
C098 78                 1080        LD   A,B
C099 E680               1090        AND  £80
C09B B9                 1100        CP   C
C09C 2802               1110        JR   Z,SUB7
C09E D73E               1120        RCAL SUB3
C0A0 D5                 1130 SUB7   PUSH DE
C0A1 1E05               1140        LD   E,05
C0A3 D71D               1150        RCAL SUB4
C0A5 78                 1160        LD   A,B
C0A6 E601               1170 LBL14  AND  01
C0A8 2004               1180        JR   NZ,LBL2
C0AA D716               1190        RCAL SUB4
C0AC 1802               1200        JR   LBL3
C0AE D70E               1210 LBL2   RCAL SUB5
C0B0 1D                 1220 LBL3   DEC  E
C0B1 2805               1230        JR   Z,LBL4
C0B3 78                 1240        LD   A,B
C0B4 1F                 1250        RRA
C0B5 47                 1260        LD   B,A
C0B6 18EE               1270        JR   LBL14
C0B8 D704               1280 LBL4   RCAL SUB5
C0BA D715               1290        RCAL SUB6
C0BC D1                 1300        POP  DE
C0BD C9                 1310        RET
C0BE 3E00               1320 SUB5   LD   A,00
C0C0 1802               1330        JR   LBL5
C0C2 3E20               1340 SUB4   LD   A,£20
C0C4 F5                 1350 LBL5   PUSH AF
C0C5 21000C             1360        LD   HL,£0C00
C0C8 7E                 1370        LD   A,(HL)
C0C9 E6DF               1380        AND  £DF
C0CB 77                 1390        LD   (HL),A
C0CC F1                 1400        POP  AF
C0CD 86                 1410        ADD  A,(HL)
C0CE D300               1420        OUT  (00),A
C0D0 77                 1430        LD   (HL),A
C0D1 D5                 1440 SUB6   PUSH DE
C0D2 ED5BE20E           1450        LD   DE,(£0EE2)
C0D6 15                 1460 LBL6   DEC  D
C0D7 20FD               1470        JR   NZ,LBL6
C0D9 1D                 1480        DEC  E
C0DA 20FA               1490        JR   NZ,LBL6
C0DC D1                 1500        POP  DE
C0DD C9                 1510        RET
C0DE FE80               1520 SUB3   CP   £80
C0E0 2809               1530        JR   Z,LBL7
C0E2 C5                 1540        PUSH BC
C0E3 061B               1550        LD   B,£1B
C0E5 D7B9               1560        RCAL SUB7
C0E7 C1                 1570        POP  BC
C0E8 0E00               1580        LD   C,00
C0EA C9                 1590        RET
C0EB C5                 1600 LBL7   PUSH BC
C0EC 061F               1610        LD   B £1F
C0EE D7B0               1620        RCAL SUB7
C0F0 C1                 1630        POP  BC
C0F1 0E80               1640        LD   C,£80
C0F3 C9                 1650        RET
C0F4 2AE40E             1660 SUB2   LD   HL,(£0EE4)
C0F7 46                 1670 LBL10  LD   B,(HL)
C0F8 23                 1680        INC  HL
C0F9 BE                 1690        CP   (HL)
C0FA 23                 1700        INC  HL
```

```
C0FB C8          1710          RET  Z
C0FC F5          1720 LBL8     PUSH AF
C0FD 7E          1730          LD   A,(HL)
C0FE FEFF        1740          CP   £FF
C100 2803        1750          JR   Z,LBL9
C102 F1          1760          POP  AF
C103 18F2        1770          JR   LBL10
C105 F1          1780 LBL9     POP  AF
C106 FE0A        1790          CP   £0A
C108 0682        1800 LBL13    LD   B,£82
C10A C8          1810          RET  Z
C10B FE0D        1820          CP   £0D
C10D 200D        1830          JR   NZ,LBL11
C10F 0688        1840          LD   B,£88
C111 D78D        1850          RCAL SUB7
C113 3E10        1860          LD   A,£10
C115 D7BA        1870 LBL12    RCAL SUB6
C117 3D          1880          DEC  A
C118 20FB        1890          JR   NZ,LBL12
C11A 18EC        1900          JR   LBL13
C11C 0684        1910 LBL11    LD   B,£84
C11E C9          1920          RET
C11F 83419942    1930 TABLE    DEFW £4183,£4299,£438E,£4489
     8E438944
C127 81458D46    1940          DEFW £4581,£468D,£479A,£4894
     9A479448
C12F 86498B4A    1950          DEFW £4986,£4A8B,£4B8F,£4C92
     8F4B924C
C137 9C4D8C4E    1960          DEFW £4D9C,£4E8C,£4F98,£5096
     984F9650
C13F 97518A52    1970          DEFW £5197,£528A,£5385,£5490
     85539054
C147 87559E56    1980          DEFW £5587,£569E,£5793,£589D
     93579D58
C14F 9559915A    1990          DEFW £5995,£5A91,£3117,£3213
     17311332
C157 01330A34    2000          DEFW £3301,£340A,£3510,£3615
     10351536
C15F 07370638    2010          DEFW £3707,£3806,£3918,£3016
     18391630
C167 193F032D    2020          DEFW £3F19,£2D03,£3A0E,£250D
     0E3A0D25
C16F 1A401424    2030          DEFW £401A,£2414,£280F,£2912
     0F281229
C177 1C2E0C2C    2040          DEFW £2E1C,£2C0C,£2705,£3D1E
     05271E3D
C17F 1D2F112B    2050          DEFW £2F1D,£2B11,£2205,£330E
     05220E3B
C187 14230817    2060          DEFW £2314,£1708,£2A1A,£00FF
     1A2AFF00
                 2070 : END
```

Listing 1. The full assembly code listing for the Gadabaud program.

```
0000 D7 02 DF 5B F5 E5 D5 D7
0008 C0 E1 11 3F 00 19 22 78
0010 0C 22 05 0F 11 D7 00 19
0018 22 E4 0E 21 DF 75 22 1D
0020 10 3E C9 32 1F 10 21 7F
0028 07 22 73 0C 21 82 07 22
0030 75 0C 21 2F 00 22 7B 0C
0038 21 FF FF 22 E0 0E 21 13
0040 50 22 E2 0E D1 E1 F1 C9
0048 F5 CB 77 28 02 CB AF FE
0050 0A 20 0B 3A E1 0E FE 0D
0058 28 24 3E 0A 18 1E FE 3C
0060 20 06 3E 4C D7 1D 18 08
0068 FE 3E 20 08 3E 47 D7 13
0070 3E 54 18 08 FE 5E 20 04
0078 3E 2A D7 07 D7 05 F1 32
0080 E1 0E C9 E5 C5 F5 3A E0
0088 0E 4F F1 F5 D7 08 79 32
0090 E0 0E F1 C1 E1 C9 D7 5C
0098 78 E6 80 B9 28 02 D7 3E
00A0 D5 1E 05 D7 1D 78 E6 01
00A8 20 04 D7 16 18 02 D7 0E
00B0 1D 28 05 78 1F 47 18 EE
00B8 D7 04 D7 15 D1 C9 3E 00
00C0 18 02 3E 20 F5 21 00 0C
00C8 7E E6 DF 77 F1 86 D3 00
00D0 77 D5 ED 5B E2 0E 15 20
00D8 FD 1D 20 FA D1 C9 FE 30
00E0 28 09 C5 06 1B D7 B9 C1
00E8 0E 00 C9 C5 06 1F D7 B0
00F0 C1 0E 80 C9 2A E4 0E 46
00F8 23 BE 23 C8 F5 7E FE FF
0100 28 03 F1 18 F2 F1 FE 0A
0108 06 82 C8 FE 0D 20 0D 06
0110 88 D7 8D 3E 10 D7 BA 3D
0118 20 FB 18 EC 06 84 C9 83
0120 41 99 42 8E 43 89 44 81
0128 45 8D 46 9A 47 94 48 86
0130 49 8B 4A 8F 4B 92 4C 9C
0138 4D 8C 4E 98 4F 96 50 97
0140 51 8A 52 85 53 90 54 87
0148 55 9E 56 93 57 9D 58 95
0150 59 91 5A 17 31 13 32 01
0158 33 0A 34 10 35 15 36 07
0160 37 06 38 18 39 16 30 19
0168 3F 03 2D 0E 3A 0D 25 1A
0170 40 14 24 0F 28 12 29 1C
0178 2E 0C 2C 05 27 1E 3D 1D
0180 2F 11 2B 05 22 0E 3B 14
0188 23 08 17 1A 2A FF FF FF
```

Listing 2. Gadabaud in Hex dump format for quick entry. The highlighted bytes are those concerned with the timing and are set for 4 MHz operation without Wait States.

```
 10 REM  THIS PROGRAM FRAGMENT SHOWS HOW TO USE
 20 REM  GADABAUD 1.3 TO CONTROL A PRINTER FROM
 30 REM  WITHIN A BASIC PROGRAM. IT MAKES NO
 40 REM  DIFFERENCE IF TOOLKIT IS ACTIVATED:
 50 REM  INITIALISING GADABAUD WILL DISABLE
 60 REM  TOOLKIT BY RESETTING THE I/O TABLES.
 70 REM
 80 REM  INITIALISE GADABAUD-
 90 REM  GADABAUD AT C00 (HEX) = -16384 (DEC)
100 DOKE 4100,-16380
110 X=USR(0)
120 REM  SET U MODE
130 DOKE 3189,1921:DOKE 3187,1918
140 PRINT:PRINT'OUTPUT TO SCREEN AND PRINTER'
150 REM  SET N MODE
160 DOKE 3189,1922:DOKE 3187,1919
170 PRINT:PRINT'OUTPUT TO SCREEN ONLY':PRINT
180 END
```

Listing 3. An example of how to control Gadabaud from within a BASIC program.

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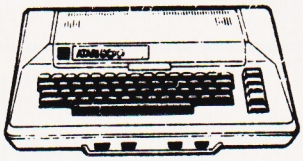

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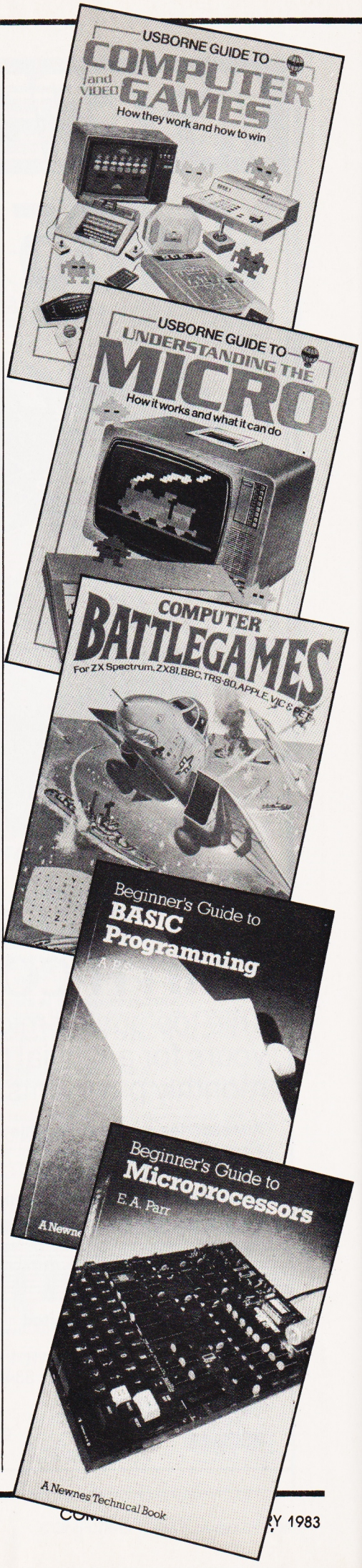
BOOK PAGE

We turn our attention this month to a selection of books that offer a starting point for the beginner.



This month we take a look at some new books that are aimed at the newcomer to computing. Before you move on to read another article because you feel that the title 'newcomer' doesn't fit you, let me say that I don't think I could be described as a newcomer to computing but I found some of the books discussed in this review surprisingly interesting and informative. The reason for this is that there are many facets to computing. So, some introductory books explain computing with an audience of electronics engineers in mind, others assume a knowledge of software and tell you about hardware and still others assume no knowledge at all. The chances are that there is an area of computing that you have missed out on somewhere along the line.

The second thing about introductory books is that they can sometimes be entertaining and often throw some new light on computing by treating it in a way that advanced books shun.

The first book this month is **Beginner's Guide to Microprocessors** by E A Parr. This is an engineer's book in the sense that it delves deeper into electronics than most beginner's books. Starting off with a very simple description of what a computer is it is not long before logic symbols and even circuit diagrams start to appear. Later on in the book there are thumbnail sketches of some common and popular microprocessors — including the Z80, the 6502 and the 6809. What is interesting is that there are also brief details of some not-so-popular micros, the 2650, the SC/MP and the IM6100. It is this mixture of introductory explanations of the commonplace and the out of the way material that makes this book of interest to a wider audience than just the beginner. My only reservation is that the slightly more advanced 'asides' might actually be irritating to the complete beginner and could make it a little difficult to decide what is essential knowledge. However, if you want a book that emphasises the microprocessor side of computing then this book will satisfy you well beyond the introductory stage.

The similarly named **Beginner's Guide to BASIC Programming** is part of the same series and has been written by A P Stephenson who will be no stranger to readers of *Computing Today*. This book is well written and well presented and gives a 'straight' introduction to a general version of Microsoft BASIC, without any particular machine in mind. The fact that it has been written for a wide audience using a range of machines is its biggest difficulty. If you have a ZX Spectrum, a ZX81, a BBC Micro or any other very popular micro there are books that will teach you BASIC for your particular machine. If you can overcome any initial difficulties involved in getting your machine started and entering programs, then this book will help you learn a 'middle-of-the-road' dialect of BASIC but won't tell you anything about your specific version of BASIC — but, after all, that's what manuals are for.

Microprocesors: Your questions answered by Alec Wood is a book with a question and answer format but the questions are ones posed by the author and, in that sense, not 'your' questions. The format is, however, helpful in that it allows a great deal of ground to be covered. Again this is a book with a bias towards the engineering/electronics side of its subject and most of the pages of the book include either a circuit or logic diagram. Even the section on programming rapidly turns to machine code programming and features questions like 'How do I write a program in hexadecimal?'. The diagrams in this book are very good and make some obscure ideas very clear. I enjoyed it because it explains things I previously only very vaguely knew about.

Usborne have just recently brought out a series of really colourful books that you might dismiss as being 'just for kids'. Well they certainly will appeal to youngsters as they are remarkably stylishly presented — being well written and

superbly illustrated — but they are highly recommended to anybody of any age. The full range of the titles I've been looking at is listed below and as there are six of them I can't really tell you about them all! I looked first at **Understanding the Micro** and was impressed by the quality and relevance of the material covered. Personally I am often sceptical about the use of cartoons and so on to make technical information more palatable but this book, and its companion volumes, show just how illustrations should be used. The summary of machines at the end of this book is excellent and up-to-date. It is, however, extremely short so it does not give you enough information to actually select a machine but would probably enable a prospective buyer to rule some out of further consideration.

I was particularly struck by **Computer and Video Games** which has the subtitle 'How they work and how to win'. It tells you about computer technology without making it seem like hard work via hints and tips about arcade games. This is the ideal book to convert the arcade games freak to 'real' computing.

There are two volumes of programs, **Computer Spacegames** and **Computer Battlegames.** Each of them is supposed to contain 14 programs but I could only find 13 Spacegames so one of us can't count! All the programs are very short — few are more than 30 lines long — and, apart from the very last program in each book, they do not make use of graphics — the reason for this being that they have been written to run on seven popular micros (ZX Spectrum, ZX81, BBC Micro, TRS-80, Apple, VIC and PET). As listed, the programs run on the ZX81 but lines that need to be changed to run on one of the others in the list are marked and the lines to be substituted are given at the end of each program. The final program in each book is a graphics game and a separate version is listed for each machine — except that there is no PET version of either. These are very simple programs that are packaged very attractively. There is some danger that users may be a little disappointed that the games themselves are not as lavish as the illustrations — for one thing none use colour — but at £1.99 you can't really complain. I liked the way that the programs were annotated and was pleased by the inclusion of the section on adding to the programs at the back of each book.

The books included in this month's selection were:

Beginner's Guide to Microprocessors by E A Parr, published by Newnes Technical Books (1982), 218 pages, £3.95
Beginner's Guide to BASIC Programming by A P Stephenson, published by Newnes Technical Books (1982), 160 pages, £3.95
Microprocessors: Your Questions Answered by Alec Wood, published by Newnes Technical Books (1982), 155 pages, £5.45
Understanding the Micro by Judy Tatchell and Bill Bennett, published by Usborne, (1982), 48 pages, £1.65
Computer and Video Games by Ian Graham, published by Usborne, (1982), 48 pages, £1.65
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Computer Spacegames by Daniel Isaaman and Jenny Tyler, published by Usborne, (1982), 48 pages, £1.99.

GAME FOR A LAUGH?

PYTHONESQUE (£16) is a rather unusual adventure game. For copyright reasons we can't tell you what inspired the game, but if you've got a 32K PET/CBM you can find out — and have fun at the same time.

And now for something completely different. **ROBBER (£12)** is a 16K adventure that finds you on the wrong side of the law; or perhaps you'd prefer **HAUNT (£12)**, an eery encounter with ghouls and ghosts that'll give you sleepless nights! That old favourite, the **HITCH-HIKERS GUIDE TO THE GALAXY (£16)** is still available for 32K PETS, along with that other masterpiece from the irrepressible Bob Chappell, the **CRACKS OF DOOM (£16)**.

If playing arcade games is your kind of fun then you've come to the right paragraph. Believe it or not we're more than doubling our range with new games like **BLAKATAK**, **MANGROVE**, AND **TANK ZONE** AT **£8**, or **INVADERS PART 2** and **COSMIC BANDIT** for only **£6**. And there's a real treat in store if you've got 16K of memory — a superb PET version of **SCRAMBLE** for just **£10**!

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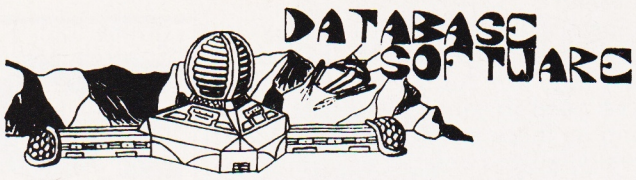

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CT Jan '83

PRINTOUT

Dear Sir,

I would have thought that the very first requisite of Editorship was that of being able to spell one's own language.

Highly technical messages from anybody, written in a language that they cannot spell, are probably nonsense; and actually not worth buying, at any price. Something better than Comprehensive School English is called for in a technical journal; and it is your responsibility to provide it. To allow the printing and distribution of spelling mistakes which the trendiest teacher would correct for a 10 year-old is totally incompetent.

Yours faithfully,
L G L Unstead-Joss
Edinburgh

(*Mr Unstead-Joss enclosed with his letter a page from a past issue containing three spelling mistakes, the responsibility for which undoubtedly does rest upon the Editor's shoulders. However, in traditional publishing houses it is the sub-editor who checks the spelling rather than the man at the top, a point which seems to have eluded our correspondent. Further, I am not sure of the relevance of the comment about Comprehensive education, I would hope that they could teach correct spelling too, or maybe it was meant to imply that I must have been taught at one . . . Whatever the reason, Mr Unstead-Joss sadly didn't apply for the post of Assistant Editor that we recently advertised (maybe he finds as many spelling mistakes in the Guardian as he does in my magazine) nor did he offer to help us read the average 150,000 words per month that we have to plough through. We could have done with the help! Ed.*)

Dear Sir,

After having bought several of the last issues of Computing Today, I have taken the plunge and sent off my subscription order.

However I thought you might like to know a bit more about why I chose Computing Today from the 20-plus 'micro-mags' on my newsagent's displays. First and foremost it was the superbly readable and useful series on 'Elegant Programming' by Mike James that did it. I hope you paid him well, and that this series will be a regular feature. Interfacing and hardware details are also interesting.

If I may take the liberty of also giving you a 'brickbat', I wish you, along with all your competitors, would require that every machine specific instruction, including POKEs and PEEKs, to be followed by a REM defining what it does. Every such idiosyncrasy means yet another program not useful to the reader with a different machine to that used by the author.

I would also like to see some articles on setting up and running a small micro-business, 'software house', etc.

Keep up the good work!
Yours faithfully,
John D Laird D Phil
The Netherlands

Dear Sir,

I use a Tandy Model I with DOS, together with TRSDOS and NEWDOS 80. Using the utility called Superzap, available on NEWDOS, one can modify any disc which runs on the Tandy system. Whilst experimenting on TRSDOS I found that if all the occurences of FE 23 in FORMAT/CMD were changed to FE 28 then the utility would actually format 40 tracks instead of the usual 35. Encouraged by this I then altered the two occurences of FE 23 in SYS0/SYS and followed this by changing the lockout bytes on the granule allocation table from FF to FC.

Hey Presto! The TRSDOS system would now read and write up to 40 tracks. However, I am unable to get BACKUP to copy beyond 35 tracks and the FREE library command still does its calculations based on 35 tracks. That is, until the disc is filled beyond 35 tracks when it indicates true free space.

Purely out of interest I wonder if any reader could supply the information to make TRSDOS fully 40 track compatible?

Your recent lower case conversion program for the Tandy was excellent for those of us with the correct character generator but I bet you have taken a lot of stick from those users with the Motorola one when they found all those funny squiggles on the screen. I am sure that by the time this letter is published you will have produced the appropriate 'fixes' so I will just mention that if the spare OR gate in Z25 is used to feed pin 11 of the new memory chip then this can be made to work correctly with either the old pseudo bit 6 generation OR the new lower case input. You can check the exact details in the Custom TRS-80 book, which also gives a design for bank switched ROM/RAM for the unused 'hole' in the memory map from 3000 to 3700 Hex.

Yours faithfully,
D Watts
Lincoln

Dear Sir,

One of your correspondents in the issue dated September suggests that firms should wait until they have their operational bugs ironed out and stocks prepared before advertising.

One reason why they may not do this is the long copy dates required by most monthly magazines. If the timing is at the worst possible point, an advertiser can wait two or three months for his advertisement to appear. If he has money tied up in idle stocks over that period, then he may even go bankrupt. Therefore, he has to estimate when the product will be available, and advertise in advance.

The New Scientist is a weekly magazine of similar size, price, and format to most monthlies. Yet it offers a copy date for its classified advertisements of only three days in advance of the publication day. This demonstrates beyond any argument that it is both physically and humanly possible to achieve this.

Another related problem is the price of computer software. This is that the cost of advertising low volume low cost items often turns out to be over 50% of the selling price. A solution to this would be to have special advertising rates for low cost software. Ultimately this would be a valuable service to readers. If writers of programs could afford to sell them

personally, then they could do so without charging VAT, and they may well agree to sell them for little more than the royalty paid to them by publishers. This could result in a drop of software prices by as much as 50 to 75%. Clearly this would be a valuable service to your readers.

A computer game that one may play for a few days and then forget about is a waste of £5, in my opinion. Many more would be bought if they were very much cheaper. This can only be achieved by elimination of the parasitic costs of distribution.

Yours faithfully,
John de Rivaz
Truro

Dear Sir,

I read with interest Mr Rainey's observations on the article 'Case Converter' published in your September issue. I shall find the extra graphics available with his lower case driver useful.

However, if you only use lower case occasionally, such as for word processing, or to run programs specifically written in lower case, then the modification can become little irksome. The situation can even become intolerable if you have lots of BASIC programs containing machine language subroutines that over-write the driver, or worse still, BASIC programs that take up a full 16K of memory, (assuming you are poor like me and only have 16K anyway).

The answer is simple. All you have to do is re-synthesise bit six when the driver is not loaded. The easiest way to do this is to connect a miniature SPST switch across the foil cut next to pin 13 of Z27. The switch can be fitted below the DIN plugs on the flat edge of the right hand support leg.

With the switch made, the NOR gate from the tri-state buffer is reconnected and bit six reappears on the data bus which forces the MCM 6670P to revert to its original character set. The net effect is to make the modification transparent to the user.

I usually power up with the switch made, which allows me to use all my original programs normally, or I can load the driver and then switch the NOR gate out.

I hope you will pass this simple modification on to your readers, even if you don't publish the letter. It really does make life easier.

Yours faithfully,
R I Bott
West Midlands

PS The upper/lower case routines contained in Scripsit 1.0 work perfectly with 'Case Converter'.

Dear Sir,

I was dissapointed to learn that my letter in the August issue seemed to have started a cold war between owners of the BBC Micro and the ZX Spectrum. Mr Spiers in his letter of the October issue accused me of denigrating the ZX Spectrum which is something that I thought that I had avoided doing. I would like to make it clear that it was the final page of Sinclair's advertisement that I was criticising and not the ZX Spectrum itself. Clive Sinclair has done a lot for computing in this country and now with the ZX Spectrum he has a product that is capable of selling itself without twisting and belittling facts about the opposition (as Mr Smith noted in his letter). I am a student of Electronics and I bought my BBC Micro because I had no doubt that with its well designed assembler and its numerous facilities for I/O etc, it was the ideal computer to support my course. However, we have also ordered a ZX Spectrum for my younger brother who has just taken Computer Studies as part of his O Levels.

I firmly believe that even at £400 the BBC Model B is underpriced for such an advanced and expandable specification. It is nearsighted of Sinclair to give the impression in his advertisements that the ZX Spectrum is better value for money than the BBC Micro, it is not.

The BBC Micro and the ZX Spectrum are two equally fine computers, but with two quite separate markets.

Yours faithfully,
Brian Beattie
Co Antrim

Dear Sir,

Every Sunday evening the Dutch radio service transmits two computer programs in a form of 'standardised' BASIC which can be accepted by most computers. The programs are sent in listed format as straight ASCII using 2400 Hz as logic '1' and 1200 Hz as logic '0' at a transmission speed of 1200 bits per second. The time of transmission is approximately 18.40 UTC and on the medium wave band, 747 kHz.

I live five miles south of Copenhagen and have had considerable success with picking up the programs and loading them onto my ABC 80. As the distance from my home to the transmitter is around 400 miles, more than twice the distance that London is, I think that this could be of interest to your readers. The program material is certainly not beginner's stuff, listings as long as 10K have been sent.

The Dutch radio service have issued a booklet which contains information about the protocol used by the transmission system and suitable translation programs for many common computers. More information can be obtained by writing to: Hans G Janssen, HOBBYSCOOP, Postbus 1200, 1200 BE Hilversum, The Netherlands.

Yours faithfully,
F Liisberg
Copenhagen

Dear Sir,

In his review of the Grundy NewBrain, Mike James queries the use of the word compiler to describe the BASIC and suggests that it is in fact the same as the Microsoft interpreter.

The manual suggests that the NewBrain stores the 'pseudo-compiled' code — I suspect that Microsoft does not — so that if a loop or subroutine, for example, is executed several times it need only be compiled once. This might explain the remarkable speed of program execution.

One feature that is remarkable by its absence from the review is the built-in formatting of numbers, for example PRINT X [5.2] would print the value of X with five digits before the decimal point and two after with any leading zeros being suppressed.

Yours faithfully,
Carl Zetie
Taplow

(*I think you may have slightly missed the point about the workings of the BASIC. The NewBrain BASIC will operate in immediate mode, something that a true compiler cannot and so it cannot begin to produce that 'half-way' code until RUN is typed. Once the program is running it does produce a very compact and fast object code version of the BASIC but it takes time to get there. It is this unnecessary complication that was being questioned with the suggestion that Microsoft would have done just as well as the commands offered by NewBrain BASIC are fundamentally similar. Ed.*)

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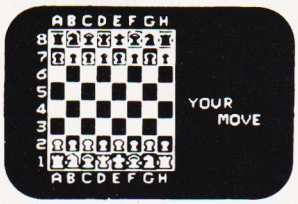

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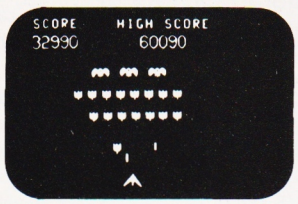

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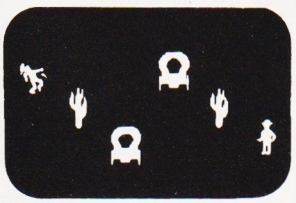

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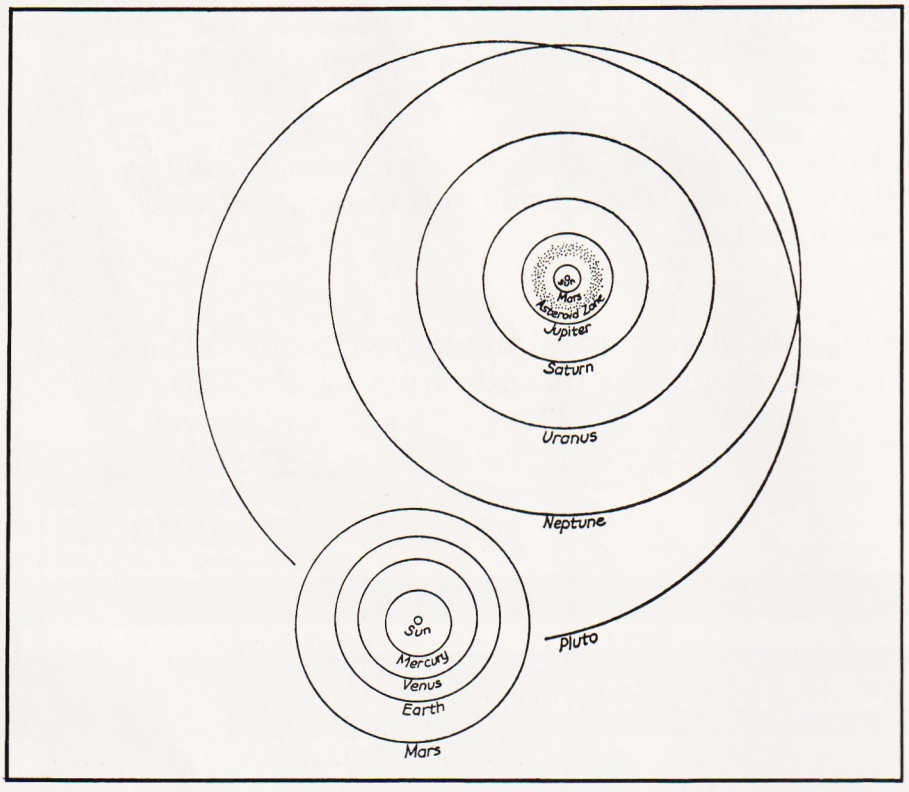
CT Jan '83

C R Dickens

KEPLER'S REVENGE

Some time ago we published a program which simulted the action of Newton's Laws of gravitation. Here is its companion which shows the motions of the planets of our solar system on your BBC Micro.



Since Kepler discovered the three laws which bear his name relating to the physical motions of the planets, and Newton interpreted them with his theory of gravitation, (helped by the apple!), the movement of the planets in their orbits has continuously fascinated astronomers. Kepler said that the planets move in ellipses with the Sun at one focus; the line connecting the Sun to a planet sweeps out equal areas in equal times; and the square of the revolution period is proportional to the cube of the distance from the Sun.

Scientists have often tried to find a formula which will give the relative distances of the planets from the Sun. There is one well known formula known as Bode's Law which worked well with the known planets. (Planets as far out as Saturn have been known as stars in the sky since early civilizations realized that these 'stars' were wanderers — planets — among the fixed stars). For this law, take the numbers 3, 6, 12, etc, doubling each time; add 4 and start with 4 to get the sequence 4, 7, 10, 16, etc. When Uranus was discovered its relative position came very close to 196, the eighth number in the series. However the law fell down badly following the discoveries of Neptune and Pluto at 301 and 396 when the series predicted 388 and 772.

LOOKING AT IT

The planets, themselves, revolve around the Sun more or less in the same plane, known as the ecliptic. Interestingly, too, they all revolve in the same direction. Whilst their orbits are ellipses, as stated by Kepler, the eccentricities, (a number between 0 and 1 representing the oblateness of the ellipse, between a circle, eccentricity of 0, and a straight line, eccentricity of 1) are so small that for all but two of the planets, on a scale the size of a computer display screen, the orbit is indistinguishable from a circle. Thus a viewer, approaching the solar system from say, the stars Vega or Deneb, North of the ecliptic, would see the planets' orbits through his image intensifier much as they are seen in this simulation. If that same extra terrestrial being has some means of variably expanding his own time frame then he will see their relative motions as they are portrayed by this program. Of course, he would need to supress, as has been done here, the overwhelming brightness of the sun with his photon inhibitor.

The two exceptions to circles, Mercury and Pluto, clearly show up as ellipses when viewed at a suitable magnification. Pluto, in fact, appears to come within the path of Neptune such is its eccentricity, although since Pluto's path is inclined at 17 degrees to the ecliptic it does not come within millions of kilometres of its neighbour. There will seem to be a large gap between the orbits of Mars and Jupiter. This is represented by the fifth number of Bode's Law and approximately establishes the orbits of the minor planets, or asteroids, which are not shown in this simulation.

THE PROGRAM

The program will run on a minimum BBC Computer. But in order to fit it into the available free memory, the BASIC has to be typed in with very few spaces between the keywords and variables. (Typed as shown it will run on a Model A)

Take care to distinguish between a single quote (line feed) and a double quote (surrounding an alphabetic string). Integer variables are used whenever possible to save memory space.

Lines 20-100 set the orbital elements. Line 270 is long, and has to be typed as shown since all

statements in it depend upon the result of the IF . . . THEN. Lines 290-310 set the background colour and define the graphics area and origin.

Lines 430-650 are the working part of the program. Lines 450-460 establish the eccentricities, and the major and minor axes of the ellipses for Mercury and Pluto. Lines 470-520 determine the distance apart of each point of the planets' orbits to be plotted so that there is an integer number of points to each orbit; but if the number of points is three or less (line 480) then the points are plotted 'freely'. Lines 560-600 remove the four previous points which plotted a planet's position, but retain a single point to show where it has been, and lines 610-640 plot the new position.

THINGS TO TRY

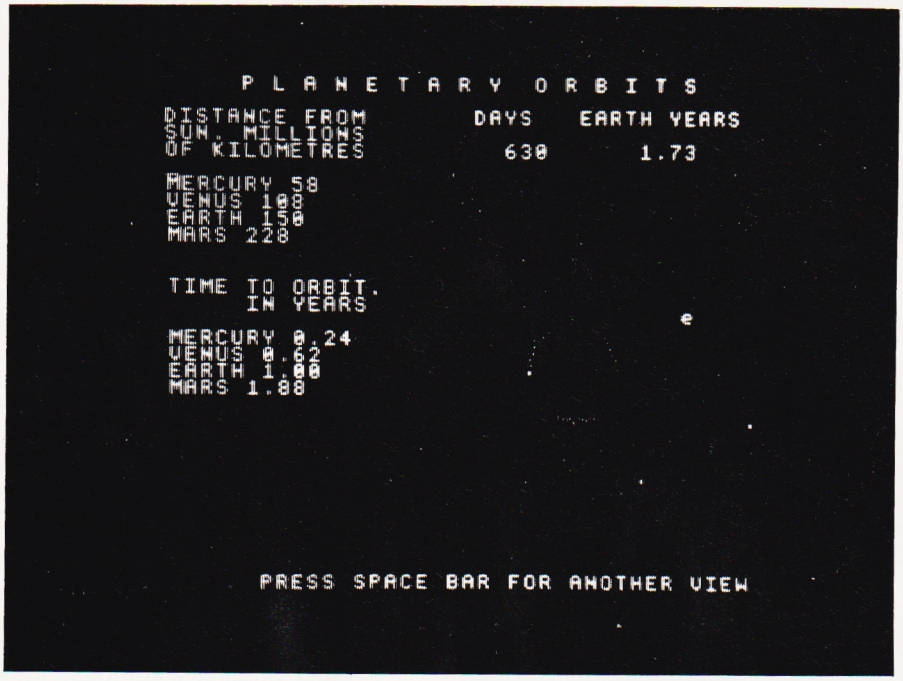
1) Look at the first two planets at seven day intervals and notice the eccentricity of Mercury.
2) View the orbit of Mars, the fourth planet, and see that Mars and Earth are in 'opposition' approximately every two Earth years.
3) Notice the large gap, where the majority of the asteroids are, between Jupiter, the fifth planet, and Mars.
4) Look out as far as six planets, at 130 day intervals, and see that the inner orbits are just distinguishable.
5) View all the planets and see that Pluto actually passes inside Neptune's orbit.
6) The Earth rotates from West to East. The view is from the North, so when Venus is the Evening Star, as distinct from the Morning Star, is it approaching the Earth or receding?

HALLEY'S RETURN

In 1986 Halley's comet will return to the environs of the Earth. You can see this object's orbit by substituting it in the program in place of Pluto.

```
100  D%(8)=2700:P%(8)=27740
460  IF J%=8 THEN E=0.967:B=A*0.255
```

But note, for highly elliptical orbits this program simulates an object's *average* speed and not its true speed according to Kepler's Second Law. This comet's orbit is best seen when viewing five or more planets.

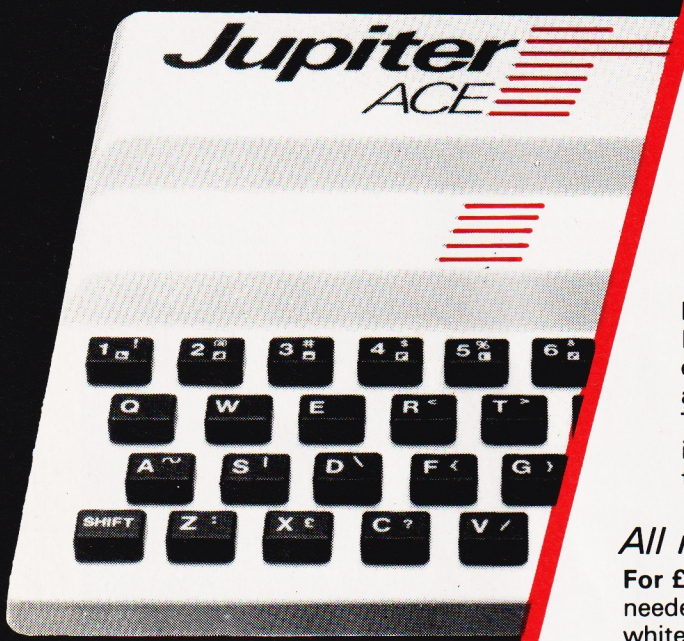


A typical screen display generated by the program using four planets.

```
  10  DIM D%(8),P%(8),I(8),A%(8),B%(8),C$(8)
  20  D%(0)=58:P%(0)=88
  30  D%(1)=108:P%(1)=225
  40  D%(2)=150:P%(2)=365
  50  D%(3)=228:P%(3)=687
  60  D%(4)=778:P%(4)=4333
  70  D%(5)=1427:P%(5)=10759
  80  D%(6)=2870:P%(6)=30685
  90  D%(7)=4497:P%(7)=60190
 100  D%(8)=5969:P%(8)=90741
 110  C$(0)="MERCURY "
 120  C$(1)="VENUS "
 130  C$(2)="EARTH "
 140  C$(3)="MARS "
 150  C$(4)="JUPITER "
 160  C$(5)="SATURN "
 170  C$(6)="URANUS "
 180  C$(7)="NEPTUNE "
 190  C$(8)="PLUTO "
 200  MODE 7
 210  H$="P L A N E T A R Y  O R B I T S"
 220  PRINT'SPC(5);H$
 230  INPUT''"HOW MANY OF THE 9 PLANETS DO YOU WISH TO
      VIEW ",S%
 240  IF S%>9 OR S%<1 THEN PRINT''"TYPE 1 TO 9";GOTO 230
 250  S%=S%-1:SIZE=D%(S%)/375
 260  INPUT''''"TIME INTERVAL (DAYS)"''"TYPE A NUMBER TO
      SHOW THE PLANETS'"''"POSITIONS AT INTERVALS OF ",T
 270  IF T<P%(S%)/90 OR T>P%(S%)/10 THEN PRINT';T" DAYS
      ARE UNSUITABLE FOR"'"VIEWING ";S%+1;" PLANETS"''
      INT(P%(S%)/50);" DAYS ARE SUBSTITUTED"''"PRESS
      SPACE BAR TO CONTINUE":T=P%(S%)/50:REPEAT UNTIL
      GET=32
 280  FOR J%=0 TO 8:I(J%)=0:NEXT
 290  MODE 4:VDU 19,0,4,0,0,0
 300  VDU 24,420;32;1279;832;
 310  VDU 29,870;432;
 320  PRINT'SPC(5);H$
 330  PRINT'"DISTANCE FROM[8 SPC]DAYS[3 SPC]EARTH YEARS"
      '"SUN. MILLIONS"'"OF KILOMETRES"'
 340  FOR J%=0 TO S%
 350  PRINT C$(J%);D%(J%):NEXT
 360  PRINT''"TIME TO ORBIT."'"[5 SPC]IN YEARS"'
 370  @%=131594
 380  FOR J%=0 TO S%
 390  PRINT C$(J%);P%(J%)/365
 400  NEXT:@%=2570
 410  PRINTTAB(6,31)"PRESS SPACE BAR FOR ANOTHER VIEW";
 420  N%=0:M=0:G=PI/180
 430  FOR J%=0 TO 8:R=D%(J%)/SIZE
 440  A=R:B=R:E=0
 450  IF J%=0 THEN E=0.2:B=A*0.98
 460  IF J%=8 THEN E=0.26:B=A*0.96
 470  P=P%(J%)/T
 480  IF P>3 THEN P=INT(P+0.5)
 490  I(J%)=I(J%)+360/P
 500  Y=G*I(J%)
 510  X=A*(COS(Y)-E)
 520  Y=B*SIN(Y)
 530  IF N%=1 THEN 550
 540  IF J%=2 THEN VDU 5:MOVE X,Y:PRINT"e":N%=1
 550  VDU 4
 560  PLOT 71,A%(J%)+2,B%(J%)+2
 570  PLOT 71,A%(J%)-2,B%(J%)+2
 580  PLOT 71,A%(J%)+2,B%(J%)-2
 590  PLOT 71,A%(J%)-2,B%(J%)-2
 600  PLOT 69,A%(J%),B%(J%)
 610  PLOT 69,X+2,Y+2
 620  PLOT 69,X-2,Y+2
 630  PLOT 69,X+2,Y-2
 640  PLOT 69,X-2,Y-2
 650  A%(J%)=X:B%(J%)=Y:NEXT
 660  M=M+T
 670  PRINTTAB(15,5),INT(M)
 680  @%=131594
 690  PRINTTAB(25,5)M/P%(2)
 700  @%=2570
 710  C=INKEY(0):IF C=32 THEN RUN
 720  GOTO 430
 730  END
```

The complete program listing for Kepler's Revenge.

Jupiter ACE



The Jupiter Ace personal computer runs in FORTH, an easily understood language, typically four times as compact and ten times as fast as BASIC. Before the Ace all personal computers used BASIC and FORTH was only available to a privileged few.

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"FORTH is an easy language"
Byte

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Speed Comparison Chart showing times in seconds to perform one thousand operations.

Type of Operation	Jupiter Ace	BBC Micro	Vic 20	Spectrum	ZX81
Empty loop	0.12	0.67	1.3	4.2	17.7
Print a number	7.5	13.5	26	19	430
Print a character	0.62	1.3	3.1	7.5	24
Add two numbers	0.45	1.4	5.5	7.5	28
Multiply two numbers	0.9	1.6	6.5	7.5	32

Because of the difficulty in devising exactly equivalent programs, these measurements should only be taken as a guide.

only £89.95

Designed by Jupiter Cantab

omputer Designers Steven Vickers and Richard Altwasser layed a major role in creating the ZX Spectrum and then ormed Jupiter Cantab to develop advanced ideas in personal omputing. The Ace is the result, another all-British computer o lead the world.

Technical Information

ardware
Z80A running at 3.25 MHz.
8K bytes ROM
3K bytes RAM

eyboard
40 Moving-key keyboard with uto repeat on every key and aps Lock.

creen
Memory mapped 32 column x 4 line flicker-free display with pper and lower case ascii haracter set.

raphics
Chunky graphics (64 x 46 xels) may be plotted, unplotted over-plotted (XOR operation). lso, the entire character set 28 characters and their video verses) may be redefined llowing intricate shapes to be rawn with a resolution quivalent to 256 x 192 pixels.

ontrol Structures
IF–ELSE–THEN, DO–LOOP O–+LOOP, BEGIN–WHILE–EPEAT, BEGIN–UNTIL, all may e mixed and nested to any epth.

Cassette
Programs and data in the compact dictionary format may be saved, verified, loaded and merged. Blocks of memory can be saved, verified, loaded and relocated. All tape files are named. Running at 1500 baud, the Ace will connect to most portable tape recorders.

Expansion Port
Contains D.C. power rails and full Z80 Address, data and control signals. May be used to connect extra memory and other peripherals. IN and OUT words allow port-based peripherals to be addressed.

Data Structures
Integer, Floating point and String data may be held as constants, variables or arrays with multiple dimensions and mixed data types. There are no restrictions on names.

Sound
Internal loudspeaker may be programmed to operate over the entire audio spectrum.

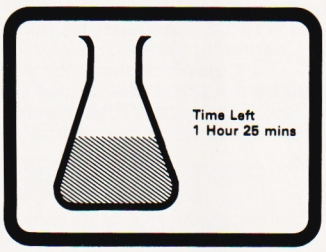
Programming in FORTH

rogramming in FORTH
FORTH programs are constructed without line-umbers, as words which are defined in terms of other ords that already exist. Consider the following efinition of the word **STARS**. Comments are in arenthesis and have no action.

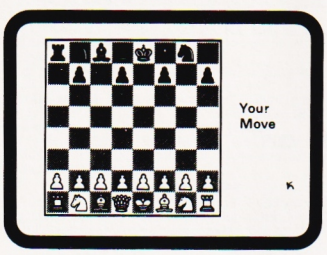
```
: STARS          (: starts word definition)
  " *** "        (print 3 asterisks)
  200 100 BEEP   (play a note for
                  100 mSecs)
```

The semi colon at the end finishes the ord definition. Now, whenever you say **TARS** the computer will print out 3 sterisks and sound a short tone. (Notice ow the word **BEEP** comes after the umbers it uses, 200 and 100. This haracteristic occurs throughout FORTH so at you write, for instance, 28 76 + instead 28 + 76.)
The Jupiter Ace already has 140 FORTH ords defined in ROM.

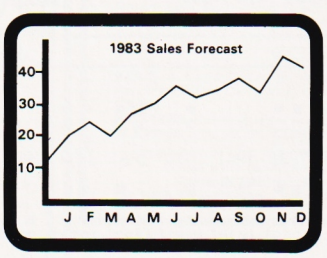
In Schools Teachers already know how quickly children take to computing, and the Jupiter Ace is an ideal introduction. FORTH is an easy and important language to learn and by making learning fun, the Ace can help to teach science, music and many other subjects.



In Laboratories For monitoring and controlling experiments, the Jupiter Ace has many advantages. The language is perfect, even the Jodrell Bank Radio Telescope is controlled in FORTH. The Ace expansion port enables it to be interfaced to almost anything, and the built in quartz timer allows experiments to run all weekend.



At Home The Jupiter Ace is powerful enough to play games as complex as Chess and with sound and high resolution graphics, action games written in FORTH will stretch your reaction speeds to their limits.



In the Office Stock control, Accounts and Financial forecasts are all possible on the Jupiter Ace. With a printer and extra memory attached you can do word processing as well.

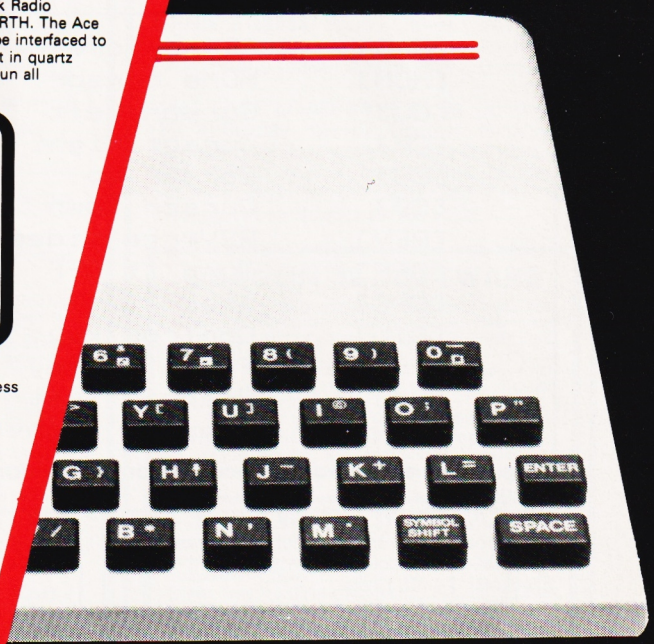
"FORTH is very flexible"

"FORTH is compact"

Electronics and computing

"FORTH is in general very much faster than BASIC"

Computing Today



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CT STANDARDS

Our regular page explaining the meaning of the various symbols we use to make programs portable.

It has been very encouraging to see the number of programs submitted using our standard codes for graphics and other non-printable characters. However, it has also become increasingly clear that some of our readers haven't heard of them and this page is intended to set them out once again.

All standards tend to be irksome to adhere to but the ones laid out here are fairly simple and tend to make software easier to maintain by the programmer and simpler to understand for others.

CONTROL THAT CURSOR

Our original standards have now grown with the times. Machines such as the Commodore VIC which have a dual Shift capability can now be incorporated, as can those systems which use Control key functions.

The recently introduced BBC system offers pre-programmed function keys which, we are glad to say, can also be handled by our original coding system. It's nice to see just how well adapted the original standards have become over the last two years! (Indeed, a whole series of books is using them as its *de-facto* standard.) The standards for the cursor controls are given in Fig. 1.

[CLS]	CLear Screen
[HOM]	HOMe cursor
[CL]	Cursor Left
[CR]	Cursor Right
[CU]	Cursor Up
[CD]	Cursor Down
[REV]	REVerse video on
[OFF]	Turn it OFF
[SPC]	SPaCe
[CTL]	ConTroL key
[fn]	Function key (BBC)
[G<]	Graphic left (VIC/MZ-80A)
[G>]	Graphic right (VIC/MZ-80A)

Fig. 1. Our extended set of cursor control standards includes four new functions.

To indicate more than one of the above, an optional number can be placed within the brackets; [4 CL], etc.

The use of square brackets has raised one or two queries. The reason for this choice is that *most* of the common microcomputer BASICs don't use them for specific functions. In fact, at least one machine provides an added bonus by returning a Syntax Error if they are found, a useful check in case you type them in by mistake.

The code [SPC] was added to the list of cursor control codes to get over the problem of indicating just how many spaces are contained in the gap in the printout. The other common variant of the code for spaces is used by the ZX people. Their choice was '_' and this crops up in the various newsletters they publish.

The code [RVS] has caused a few headaches. This is really specific to the PET where the character set can be displayed in reversed video. On machines which don't have this facility you should either find a character in the set which is the reversed image of the one you want and use that or simply ignore it and use anything else you fancy! Don't forget, you may have to look up and alter the values used elsewhere in the program.

THE GRAPHIC SOLUTION

It soon became obvious that the techniques applied to the confusing cursor controls could also be applied to the graphics symbols. The following standard is now in general use in programs published in *Computing Today*.

If a graphics character or characters are to be displayed in a listing (as opposed to POKE codes or CHR$( ) codes) then they are indicated by the method shown in Fig. 2.

Several people have asked what the relationship between the POKE value for a character and that of its shifted graphic might be. In general the shifted version of any character will be 64 greater than the value of that character. This applies to both PET and MZ-80K systems in all cases.

This can be taken further to include machines which use a pixel graphics set rather than pre-programmed PET-style characters and the series of codes for these is given in Fig. 3. As is nearly always the case there is one machine to which the standard shown in Fig. 3 does not apply — Tangerine's Microtan/Micron. This machine uses a four by two cell structure for its pixel graphics instead of the Prestel/Teletext three by two cell. The method for calculating the value to assign to 'P' is shown in Fig. 4, and is fortunately nice and simple.

MAKING REMARKS

Many people scorn the use of REMs within programs but, during the development at least, they are extremely useful. One of the documentation methods that we use is to keep our back-up copy of our programs on a 300 Baud CUTS tape with all the REMs in place: the working copy, be it on tape or disc, is REMless in order to save space.

It is also good programming 'manners' to give your REMs odd line numbers:

```
3999 REM ** CRASH PROOF INPUT
4000 INPUT "THE NUMBER OF ENTRIES ";A
```

A remarkable number of submitted programs have jumps that go not to the relevant point in the program, but to the REM statement. This can cause severe problems when re-numbering after removing the REMs.

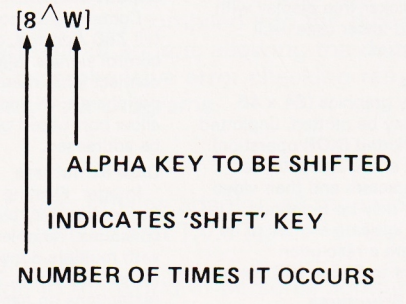

Fig. 2. The way we indicate block graphics on machines like the PET and Sharp. The VIC system of Shift Left and Shift Right is shown in Fig. 1.

1	2
4	8
16	32
64	128

Fig. 4. To convert a Tangerine pixel code into its blocks, simply decode the number into its binary or Hex value and fill in the relevant squares.

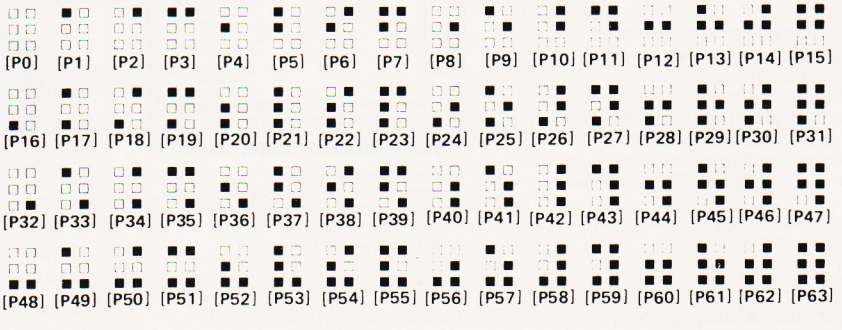

Fig. 3. The standard pixel codes; they will work on most computers which employ this technique as well as for Teletext and Prestel.

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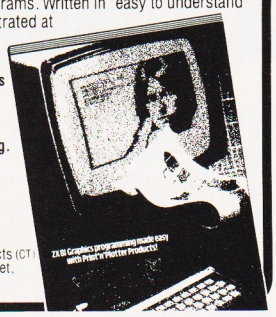

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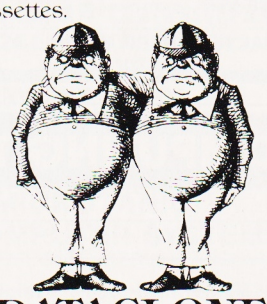

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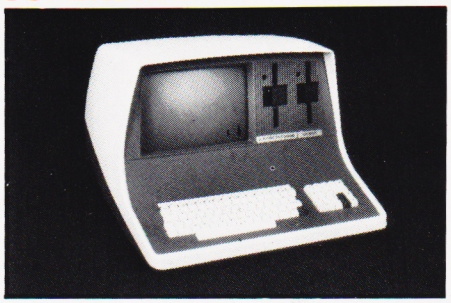

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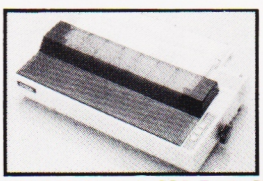

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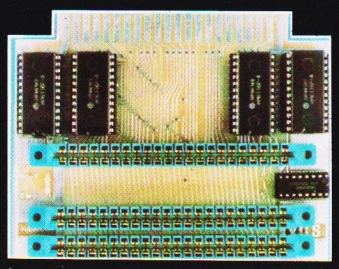

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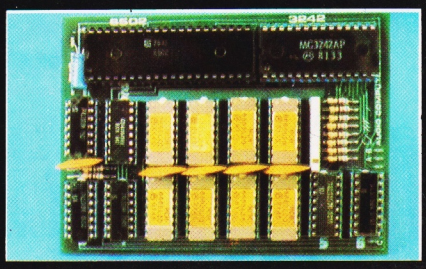

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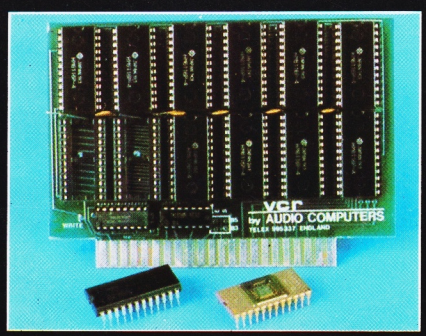

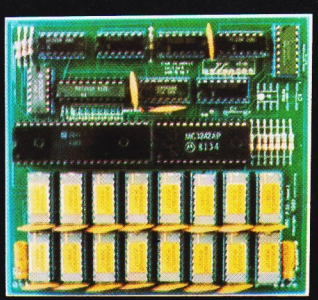

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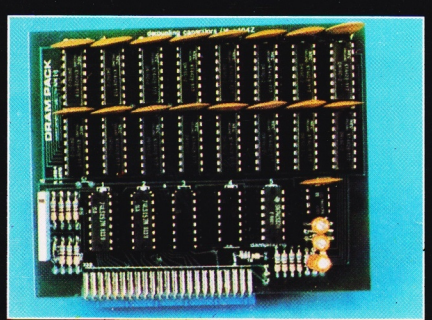

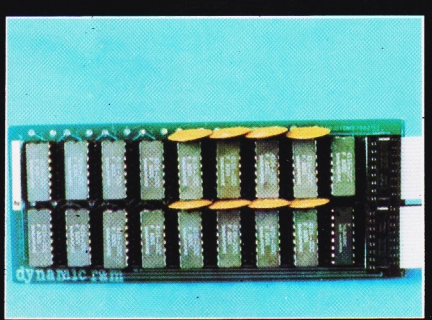

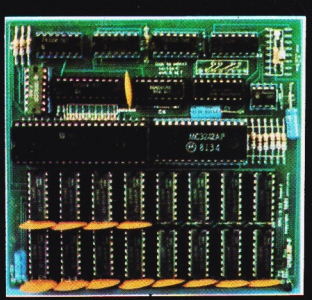

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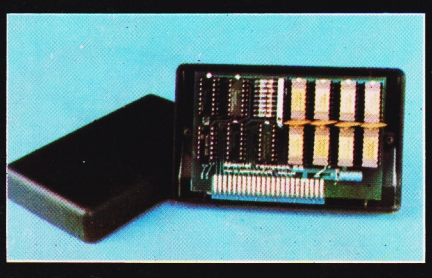

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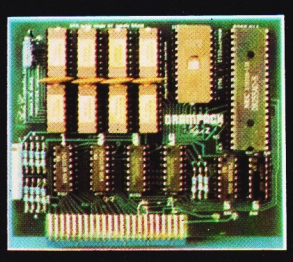

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